THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL

Vol. 65 Thursday, July 10, 1941 No. 1299

PUBLISHED WEEKLY

Subscription Terms (Home and Overseas): 21s. per annum. All Subscriptions are payable in advance.

THE FOUNDRY TRADE JOURNAL
49, Wellington Street, London, W.C.2.
WARTIME ADDRESS
to which all communications should be sent until further notice:—
3, Amersham Road, HIGH WYCOMBE, Bucks.
Telegraphic Address: "Zacatecas, High Wycombe."
Telephone: HIGH WYCOMBE 1792 (3 lines).

OFFICIAL ORGAN OF
The Institute of British Foundrymen
The Institute of Vitreous Enamellers
The Welsh Engineers' and Founders' Association
The Foundry Trades' Equipment and Supplies Association

Institute of British Foundrymen
PRESIDENT: 1940-41
W. B. Lake, J.P., Lake & Elliot, Limited, Braintree, Essex.

LIST OF SECRETARIES—
General Secretary: T. Makemson, Saint John Street Chambers, Deansgate, Manchester, 3. London Office: 49, Wellington Street, London, W.C.2.
Birmingham, Coventry and West Midlands: A.A. Timmins, F.I.C., 21-23, St. Paul's Square, Birmingham, 3.
East Midlands: S. A. Horton, "Three," Mostyn Avenue, Littleover, Derby.
Lancashire: A. Boyes, "Roseville," 7, Kirkstall Road, Davyhulme, Manchester.
London (pro tem.): V. C. Faulkner, 3, Amersham Road, High Wycombe, Bucks.
Middlesbrough (pro tem.): J. K. Smithson, North-Eastern Iron Refining Company, Limited, Stillington, Stockton-on-Tees.
Newcastle-upon-Tyne: C. Lashly, Sir W. G. Armstrong, Whitworth & Company (Ironfounders), Limited, Close Works, Gateshead.
Scottish: J. Bell, 60, St. Enoch Square, Glasgow.
Sheffield: W. Webb, B.Sc., 20, Brookfield Avenue, Swinton, Mexborough, Yorks.
Wales and Monmouth: J. J. McClelland, 12, Clifton Place, Newport.
West Riding of Yorkshire: S. W. Wise, 110, Pullan Avenue, Eccleshill, Bradford.
South Africa: F. C. Williams, Mutual Building, Corner of Harrison and Commissioner Streets, Johannesburg.

Bristol: A. Hares, 167, Ridgeway Road, Fishponds, Bristol.
Burnley: H. Buckley, Elismere, Norfolk Avenue, Burnley, Lancs.
East Anglian: J. L. Francis, 12, Glenhurst Avenue, Colchester Road, Ipswich.
Falkirk: T. R. Goodwin, "Viewfield," Falkirk Road, Bonnybridge, Scotland.
Lincoln: E. R. Walter, M.Sc., The Technical College, Lincoln.

The Institute of Vitreous Enamellers
President: Professor J. H. Andrew, D.Sc., Department of Applied Science, The University, St. George's Square, Sheffield.
Chairman: W. H. Whittle, W. H. Whittle, Limited, Eccles, near Manchester.
Hon. Secretary: Dr. G. T. O. Martin, 21-23, St. Paul's Square, Birmingham, 3.

Foundry Trades' Equipment and Supplies Association
President: G. E. France, August's, Limited, Thorn Tree Works, Halifax.
Acting Secretary: Miss L. Cox, 52, Surbiton Hill Park, Surbiton, Surrey.

Welsh Engineers' and Founders' Association
President: W. E. Clement, Morfa Foundry, New Dock, Llanelly.
Secretary: J. D. D. Davis, 9, Royal Metal Exchange, Swansea.

BRITISH CAST IRON RESEARCH ASSOCIATION
The Registered Office and Laboratories of the B.C.I.R.A. are:—
21-23, ST. PAUL'S SQUARE, BIRMINGHAM
Telephone; Colmore 4274-4275 Telegrams: CIRA
The B.C.I.R.A. Scottish Laboratories are:—
Foundry Technical Institute, Meek's Road, Falkirk
Telephone: 332

Contents

	PAGE
New York Convention Papers—I	15
Institute of British Foundrymen	16
A Provincial Metallurgical Gathering	16
Book Review	16
Random Shots	16
Some Reactions Affecting the Resistance of Cast Iron to Deflection under Load at High Temperatures	17
Foundry Technique in the Production of High Strength and other Types of Alloy Grey Iron Castings	19
Maintaining Economic Prices	22
Moulding a Bend Pipe Breeches' Piece	23
Core Trays and Packers	26
Blast Furnace Rehabilitation	26
Weight and Count	28
Correspondence	28
Powers of Minister of Supply's Controller	28
The Week's News in Brief	30
Trade Talk	30
Personal	30
Obituary	30
Reports and Dividends	30
Raw Material Markets	32

New York Convention Papers—I

It should not be thought that the 24 preprints of the Papers presented to the New York Convention of the American Foundrymen's Association constitute the whole of the material made available, for many very useful contributions, especially of a practical character, take the form of "prepared discussions" for the "shop courses" or "round-table luncheons." With such a large programme of Papers, it is easily possible to cater for all sections of the industry, and the committee responsible has certainly made an excellent and equitable selection. Thus four Papers are devoted to sand; six to cast iron, including cupola practice; four to malleable; three to steel; four to non-ferrous; and three of general interest. The most important contribution to the study of moulding sand is a Progress Report on Investigations of the Effect of High Temperatures on "Steel" Sands, which consists of three sections: No. 1, Part 2—Expansion-Contraction Tests; No. 2—Comparison of Specimen Sizes, and "The Measurement of Free Expansion of Sand Mixtures at High Temperatures." Some nine thousand dollars has already been expended since 1939 on this research which has not progressed so well as was anticipated owing to the resignation of the original investigator and the difficulty of replacing him. However, the authorities of Cornell University allowed Mr. Ehrhart to do some very useful work on the "free" expansion of sands until the appointment of Mr. J. R. Young on July 1 last year. The first worry of the new investigator was to establish a suitable size of specimen, since standardised at 1½ in. diameter by 2 in. long. This is very important as different sizes of test specimens show considerable differences in properties. It is well realised in America that much fundamental work has to be done on moulding sands before a proper understanding of all their attributes can be established and that is why this particular research is to be continued for five years. The American sand suppliers, too, are taking a hand in the game and a Paper on the "Reproducibility of Tests of Foundry Sand," by Mr. Stanton Walker, their consulting engineer, has thrown doubt on the present possibility of establishing acceptance specifications, carrying narrow tolerances, owing to the wide divergence of results yielded on the same sample when tested by forty different laboratories. This confirms an opinion which has been widely held in this country for the last few years. Whilst test results may not be reproducible in unrelated foundry laboratories, it is incontestable that they yield information of the greatest value in each individual foundry or group of works. For instance, a Paper by Mr. J. J. Boland, carrying the caption "Testing of Foundry Sand and its Co-ordination with Moulding Results," shows how the twelve foundries operated by the Griffin Wheel Company have through sand control reduced their wasters from 1.03 per cent. in 1935 to 0.56 per cent. in 1940. The fourth Paper submitted covered the practical innovation of adding clay slurry for rebonding moulding sand in the quantity production plant of Saginaw malleable ironfoundry of General Motors. The Paper was prepared by Mr. R. H. Mooney, the plant engineer, and reveals that both reduced cost and improved properties were consequent upon this new method of adding clay. Consideration of the Papers devoted to grey and malleable iron, non-ferrous and general subjects, is being deferred to a subsequent issue, as we have not yet had sufficient time to study their contents.

The steelfoundry industry was very fortunate in receiving three excellent communications. First of all, there is a Report of the Steel Division Committee on Radiography. In 1938 the Committee sent to 190 steelfoundries a rather crafty—we hope our American friends will not misinterpret our use of this word—questionnaire on radiography, and it was repeated this year. In about thirty questions an amazing amount of information was elicited. The results show that interest has grown; that the time is not yet ripe for the general imposition of acceptance tests; that the specifications so far issued need modification and clarification; that disputes as to interpretation should be a matter for adjustment between producer and consumer. Generally speaking, American opinion is in alignment with that expressed at the 1939 London Congress. In another most interesting Paper, Sims and Zapffe carry their hydrogen "war" into the steel castings territory. Using the title "The Mechanism of Pin-Hole Formation" they give a very reasonable explanation as to why the carbon-ferrous oxide reaction theory is untenable and substitute for it as a more logical explanation, the hydrogen-ferrous oxide reaction. Those readers who have followed these authors' work in connection with vitreous enamelling defects, which we were privileged to publish last winter, will agree that for novelty in experimentation and clarity in exposition, the researches of Sims and

(*Continued overleaf.*)

Institute of British Foundrymen

Birmingham, Coventry and West Midlands Branch Re-elects Officers

Members of the above Branch met at the James Watt Memorial Institute, Birmingham, on June 27 for the annual general meeting. Mr. N. C. Blythe (Branch-President) was in the chair, and MR. A. A. TIMMINS, F.I.C. (hon. secretary), in giving his Annual Report, said that from certain points of view the past year had not been a successful one for the Branch. Black-out restrictions and war conditions, combined with the fact that the majority of the members were now working long hours, had rendered it necessary to curtail their activities. They were forced to abandon the opening meeting of the session in October, but subsequently held two Saturday afternoon meetings, which were attended by visiting lecturers. Owing to the poor attendances, however, they deemed it advisable to suspend the activities of the Branch until the summer months. They were arranging a series of meetings between now and September, when the position would again be reviewed. They were not able to hold the annual dinner and dance this year, but had arranged a dance for the evening of July 17. This would be held at the Crown and Cushion Hotel, Perry Barr, tickets, inclusive of buffet, being 5s. As considerable difficulty had been experienced in arranging this event the Council appealed to members to give it their full support in order to make it both successful and enjoyable. The Branch had had a fairly successful year financially, subscriptions, though somewhat lower, reaching the creditable total of £408 2s. 6d. Compared with 1939 the statement of accounts showed an income of £168 against £144; net expenditure of £113 against £104; and a balance of £55 against £39. The membership of the Branch had been substantially constant throughout the year. It now stood at 339 compared with 340 the previous year. Whilst they had lost 12 members, four of whom had resigned, three by death, and one had been transferred to another Branch, 11 new members had been elected. At the present time seven members were serving with the Forces, and the Council recorded with regret the death on active service of one of their younger members, Sergt.-Pilot J. G. Turnbull.

The Report and Statement of Accounts having been approved, the election of officers for the ensuing year was proceeded with.

MR. T. H. GAMESON then proposed the re-election of Mr. Blythe as Branch-President, remarking that the proposition met with the approval of the Council. It had been a most extraordinary year, and a most anxious one for a branch-president. The proposal was seconded by MR. J. J. SHEEHAN and carried unanimously.

Acknowledging his re-election, MR. BLYTHE recalled that when appointed to the chair he expressed the hope that before his term of office expired he would have the honour of leading the Branch in times of victory. He hoped that his re-appointment might enable him to do so.

The whole of the other officers were then re-elected for another year, MR. GAMESON briefly thanking members for re-appointing him as Senior Vice-President.

That concluded the business of the annual general meeting. This was followed by a discussion on "Cupola Melting for High-Duty Castings," opened by MR. L. W. BOLTON, who, as the President pointed out, had stipulated that the meeting should become "a secret session of the Branch," and the discussion not reported. The points dealt with by Mr. Bolton included the coke bed; metal; coke; flux charges; air supply; carbon and sulphur pick-up and their control; and precautions necessary in melting high percentages of steel scrap.

A Provincial Metallurgical Gathering

The Iron and Steel Institute is holding a joint meeting with the Staffordshire Iron and Steel Institute at the Station Hotel, Dudley, on July 19. Mr. G. R. Bashforth, president of the Staffordshire Iron and Steel Institute, will preside, and the following Papers will be presented for discussion: "Non-Metallic Inclusions in Steel: Quantitative Evaluation—Part I," by W. H. Hatfield, D.Met., F.R.S., and G. W. Giles, and "Intercrystalline Cracking in Boiler Plates," a report from the National Physical Laboratory, Teddington (to be presented by Dr. C. H. Desch, F.R.S.).

Immediately before the above joint meeting, the Staffordshire Iron and Steel Institute will hold a luncheon, also at the Station Hotel, at 12.45 for 1 p.m., and the president and Council of that Institute have kindly invited members of the Iron and Steel Institute resident in the Birmingham district to be present on this occasion. Those desiring to attend the luncheon should apply for a ticket, enclosing a remittance of 7s. 6d. (which does not include wines) to Mr. H. A. MacColl, secretary of the Staffordshire Iron and Steel Institute, 87, Lincoln Road, Walsall.

Book Review

Recommended Good Safety Practices for the Protection of Workers in Foundries. Published by the American Foundrymen's Association, 222, West Adams Street, Chicago, Ill., U.S.A. Price $2.50.

The reviewer cannot imagine a British technical or other association serving an industry, sponsoring such a publication as this, as it is deemed wise to leave it in the hands of the Factory Department, the Royal Society for the Prevention of Accidents and certain specialised insurance companies. The Factory Acts, if intelligently interpreted and humanely applied are adequate for the purposes of British industry. However, America is a continent and perhaps legislation is not uniform throughout the States. Moreover, we believe, United Kingdom conditions as laid down by the law are even in advance of American, because the reviewer has failed to notice in this publication any reference to the drying of workers' clothes, and several other phases of recent legislation. Whilst many, if not most, of the recommendations are the law of the land here, there are some worth noting, such as the specification of widths of gangways and aisles along which molten metal has to be carried. It is impossible to tell from this book how much is enforcable legally, and how much is left to the discretion of the individual concern. The book, which is mimeographed, runs to 69 pages; it is divided into twenty-three sections and it is exceptionally comprehensive. Yet despite its encyclopædic character, the reviewer finds himself fogged on every page. For instance, Section XVI—Personal Protective Devices, recommends that "all persons engaged on handling molten metal shall wear the Congress Type Moulders' Shoes." Here the foundry owner is obliged to provide spats, but it is not compulsory for the men to wear them. Moulders' boots are covered by a B.S.I. specification. Again, Section IV—Safety Practices, merely states that "the plant structure shall be kept in a clean condition." It is a legal obligation on British foundry owners to clean the walls at stated intervals. Hence, owing to the very different legal outlook—not working conditions—in the two countries, the reviewer finds it difficult to appraise the value of this book to American industry. To the British foundry executive, it is one which will serve as a useful revision course, and provide a whole host of tips for the better conduct of one's work.

V.C.F.

Random Shots

The latest craze amongst philatelists is that of collecting metermarks. "Marksman," being of that mad fraternity, has therefore started a very specialised page of purely metallurgical metermarks. So specialised is it, in fact, that so far only two have come to hand. One is from the Timken Company of Canton, Ohio, and reads "Miles of smiles on Timken bearings"; the other is from the Ealing Park Foundry of London, and reads "Meehanite for highest grade iron castings." Needless to say, further contributions would be gratefully accepted, for which "Marksman" would cheerfully swap one 2½d. present reign OG mint. In this way "Marksman" hopes to make secure a seemingly wobbly financial future; first, by issuing, in about ten years' time, a catalogue of metallurgical metermarks, and later, having created the price standard to suit the requirements of a comfortable retirement, by the sale of "The Superb Collection."

* * *

A novel opportunity for war work by the physically, but by no means mentally, disabled, presents itself by the issue of the new ration books. It appears that for each person there are about a dozen names and addresses to fill in (happily not all different). Imagine the trials of getting these books in order in a family, say, where Father is working more than full time in the foundry; Mother is working all day in the works' canteen; whilst the four children are being looked after at home by Grandmother, who, though still good on the pins, is decidedly poor of eyesight and suffering from a sense of being beyond coping with "them dem things," withal. Taking an average of three lines to an address, someone in that family will have to write approximately 250 lines in order to check in for rations; more lines than the average naughty schoolboy is expected to write for putting beetles in the form-master's desk.

* * *

A bright outlook for the future of the war

It is reported the Germans are experimenting with the substitution of nitrogen for nickel in Ni-Cr steels. The layman may think that they are merely taking the "i" out of Ni, but to the initiated it means not only the eye but the body, too. They also know that only the best is good enough for implements of war.

* * *

Extract from an A.F.A. Committee Report

"Foundries that use radiography are more able to see the customer's point of view." Foundry managers, long oppressed, are optimistically wondering if, by any chance, the customers could use radiography to see their point of view, for a change.

"MARKSMAN."

New York Convention Papers—I

(*Continued from page* 15.)

Zapffe well merit the international approbation they have received. The work of the [British] Steel Castings Committee as set out in the Iron and Steel Institute Special Report No. 23 of 1938 is materially enriched by a Paper by Mr. H. F. Taylor, Mr. E. A. Rominisky and Mr. C. W. Briggs in so far as the subject of the fluidity of steel is concerned. This very lengthy Paper emanates from the [American] Naval Research Laboratory with the collaboration of Briggs, the Technical Adviser to the Steel Founders' Society of America. The authors are satisfied that they have designed a testing procedure based on the spiral type of test casting which will effectively determine the proper tapping times. This established, the authors have used it for a large range of experiments and the most interesting deduction they make is that "a critical amount of oxide is necessary for maximum fluidity."

Some Factors Affecting the Resistance of Cast Iron to Deflection under Load at High Temperatures*

By L. W. BOLTON, A.M.I.Mech.E. (British Cast Iron Research Association, Birmingham)

(*Continued from page 7.*)

Influence of Phosphorus on Rigidity of Cast Iron at 850 deg. C.

In examining the influence of phosphorus, a base cast iron containing 5.5 per cent. Si was used, as this material scaled only slightly and had a very small growth. In this series (B) of bars tested, the phosphorus content varied between 0.4 per cent. and 1.1 per cent. The as-cast size of the bars in this case was 0.875 in. in dia.

The bars were produced from a mixture of mild-steel scrap, refined pig-iron and ferro-silicon (10 per cent. Si), melted in a coke-fired crucible furnace. Additions of ferro-phosphorus (20 per cent. P) were made to the molten metal

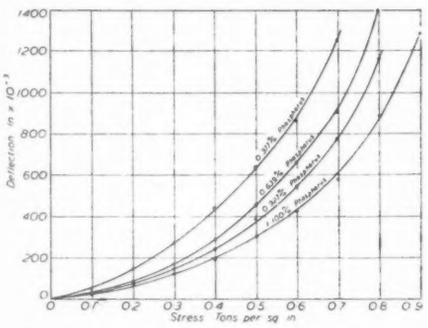


FIG. 4.—DEFLECTION OF SERIES *B* BARS AT 850 DEG. C.

TABLE II.—*Compositions of Irons, Series* B (*Increasing P*).

No.	T.C.	Si	Mn	S	P
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
7	2.40	5.59	1.20	0.035	0.377
8	2.47	5.50	1.17	0.043	0.639
9	2.42	5.42	1.14	0.039	0.927
10	2.41	5.42	1.13	0.040	1.100

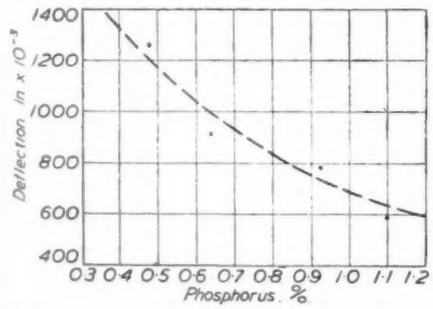


FIG. 5.—DEFLECTION OF SERIES *B* BARS AFTER 7 DAYS WITH TOTAL STRESS OF 0.7 TON PER SQ. IN. AT 850 DEG. C.

in the crucible before each bar was cast, the metal being returned to the furnace after each addition to bring it back to a suitable temperature for casting. The bars were cast in green-sand moulds, and the pouring temperature was kept as uniform as possible throughout the series. The analyses of the bars used are given in Table II, and their microstructures were shown in Figs. 17 to 20.

Fig. 4 shows the deflections of these irons under stress at 850 deg. C. It will be seen that additions of phosphorus progressively increase the stiffness of the metal at high temperatures. This stiffening influence is clearly shown in Fig. 5, where deflections are plotted against phosphorus contents for a stress of 0.7 ton per sq. in., *i.e.*, total deflection of the specimen at the end of the seventh day of the test in each case. With the exception of the phosphorus content, the analyses of the bars are very similar, and it will also be seen that the microstructures are very much alike. All the bars scaled only superficially, so that it would appear that the differences in rigidity are entirely due to the differences in phosphorus content. It should be noted, however, that the graphite size of the specimen containing 1.100 per cent. P, the most rigid under test, is slightly coarser than that of the other bars in this series.

In order to examine the influence of P on cast iron of lower Si content than Series B, two ordinary grey-iron bars (Nos. 11A and 12A) containing approximately 3.2 per cent. Si, but with widely differing phosphorus contents, were tested (Series C). The as-cast size of the bars was 0.65 in. in dia. They were produced under similar conditions to the bars in Series A, and an addition of ferro-phosphorus (20 per cent. P) was made in the case of bar 12A. The analyses are shown in Table III, and the results obtained are plotted in Fig. 6 (two lower curves).

It will be seen that the higher-phosphorus bar is more rigid than the one with low P, although

FIG. 21.—0.65-IN. DIA. BAR.

FIG. 22.—1.75-IN. DIA. BAR.

Figs. 21 and 22.—P, 0.067 per cent.; Si, 3.28 per cent.

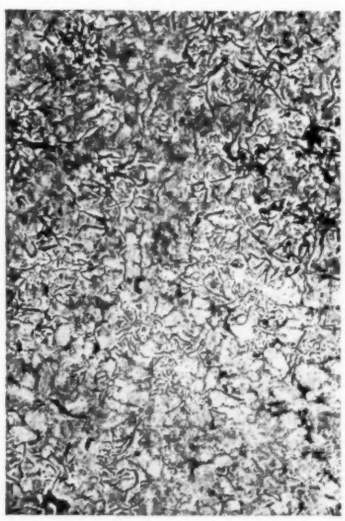


FIG. 23.—0.65-IN. DIA. BAR.

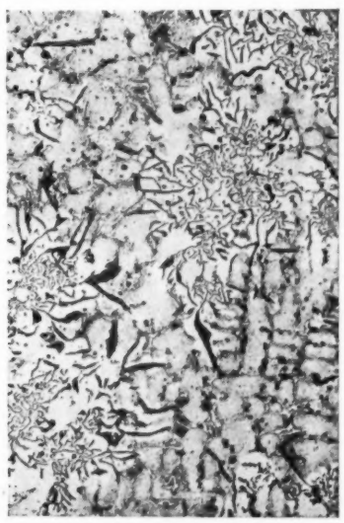


FIG. 24.—1.75-IN. DIA. BAR.

Figs. 23 and 24.—P, 1.320 per cent.; Si, 3.18 per cent.

Figs. 21 to 24.—Small and large diameter bars with different phosphorus contents, Series *D*. Etched in picric acid. Mag. 75.

the difference in rigidity in this case is less marked than would be expected from the results obtained in Series B. Both bars in Series C, however, scaled on the surface and suffered from growth, and it is likely that this to some extent masked the influence of the differences in P content. The tests on bars of Series B and C do, however, show that additions of P increase the resistance of cast iron to deflection at 850 deg. C. over the range of Si contents of the metal, 3.18-5.5 per cent.

Influence of Graphite Size on Rigidity of Cast Iron at 850 deg. C.

In order to examine the influence of graphite size, bars were cast in two different sizes from four different compositions. In each case the bar cast to the larger original diameter contained graphite in larger flakes than the small-cast-diameter bar. The metal was melted in a coke-fired crucible furnace and cast into green-sand moulds. Each pair of bars, of large and small diameter, was cast from the same crucible of molten metal. The components of the charges were the same as those employed in Series A, with an addition of ferro-phosphorus in the case of the charge from which bars 12A and 12B were cast. The pouring temperature and moulding conditions were very similar for each pair of bars, and as far as possible were kept uniform throughout the series. The differences in structure in the two different sizes of bar of the same composition are due to the influence of the section on the rate of cooling.

The microstructures of the bars, constituting Series D, are shown in Figs. 21 to 28 and their actual analyses are given in Table III. Specimens for testing at 850 deg. C. were turned from these bars. The results obtained on bars 11A and 11B and 12A and 12B are plotted in Fig. 6. These bars have similar carbon and silicon contents, but contain different amounts of P. It will be seen that the smaller-cast bars resist deflection at 850 deg. C. better than the larger bars of the same composition in each case. The large-cast-diameter high-phosphorus bar is more rigid than the large-diameter low-phosphorus bar, showing that the phosphorus has a stiffening influence, even in large-diameter bars. The finer graphite size of the 0.65-in. dia. bars (Figs. 21 and 23) compared with the larger-cast-diameter bars (Figs. 22 and 24) will be noted.

TABLE III.—*Compositions of Irons, Series* D (*Small- and Large-Diameter Bars*)

No.	Cast diam.	T.C.	Si	Mn	S	P
	In.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
11A*	0.65	3.33	3.28	0.75	0.019	0.067
11B	1.75					
12A*	0.65	3.18	3.18	0.84	0.040	1.320
12B	1.75					
13A	0.65	2.53	5.75	1.06	0.048	0.036
13B	1.20					
14A	0.65	2.67	7.16	1.17	0.031	0.031
14B	1.20					

* Bars 11A and 12A constitute also Series C, high and low phosphorus contents.

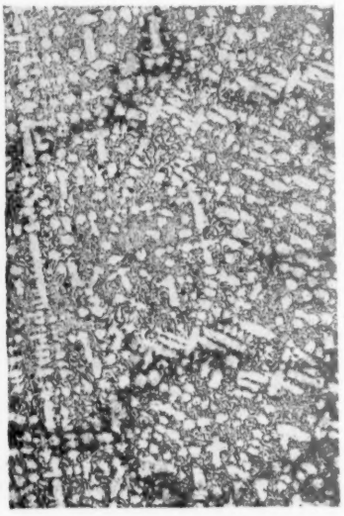


FIG. 25.—0.65-IN. DIA. BAR.

FIG. 26.—1.2-IN. DIA. BAR.

Figs. 25 and 26.—Si, 5.75 per cent.

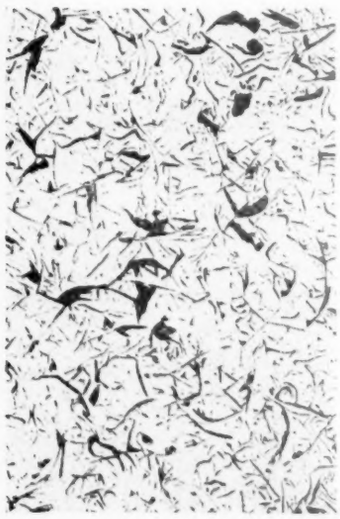


FIG. 27.—0.65-IN. DIA. BAR.

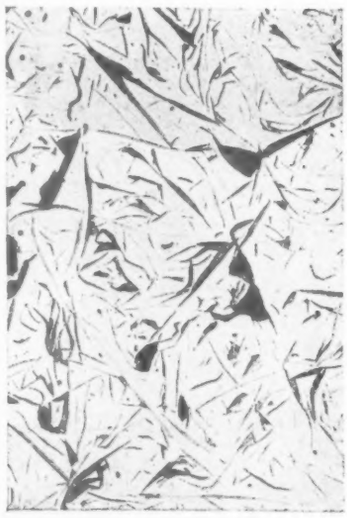


FIG. 28.—1.2-IN. DIA. BAR.

Figs. 27 and 28.—Si, 7.16 per cent.

Figs. 25 to 28.—Small and large diameter bars with different silicon contents, Series *D*. Etched in picric acid. Mag. 75.

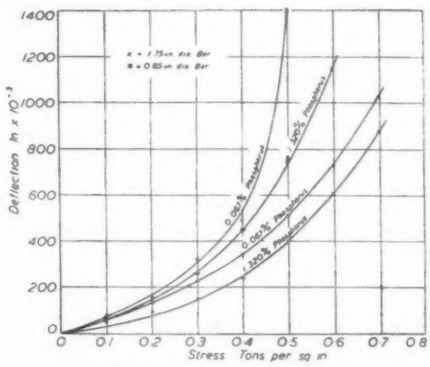

Deflection in x 10⁻³
Stress Tons per sq in
0 0·1 0·2 0·3 0·4 0·5 0·6 0·7 0·8
0 200 400 600 800 1000 1200 1400
0·065 in dia Bar
0·065 in dia Bar
0·065% Phosphorus
0·065% Phosphorus
1·320% Phosphorus
1·320% Phosphorus

FIG. 6.—DEFLECTION OF BARS OF DIFFERING PHOSPHORUS CONTENTS, SERIES *D*, AT 850 DEG. C. (THE TWO LOWER CURVES ALSO CONSTITUTE SERIES *C*, HIGH AND LOW P CONTENTS.)

Fig. 7 shows the effect of the original casting section on the stiffness of bars 13A and 13B and 14A and 14B. Both these bars have high Si contents and good heat-resisting properties. Here again the smaller bars in each case is better able to resist deflection than the larger bar of the same composition. While the higher-silicon bars are stiffer than the lower-silicon-content bars of the same as-cast size, the lower-silicon 0.65-in. dia. as-cast bar is stiffer than the higher-silicon 1.2-in. dia. bar. The relatively coarse graphite structures of the large-cast-diameter bars will be noted in Figs. 26 and 28.

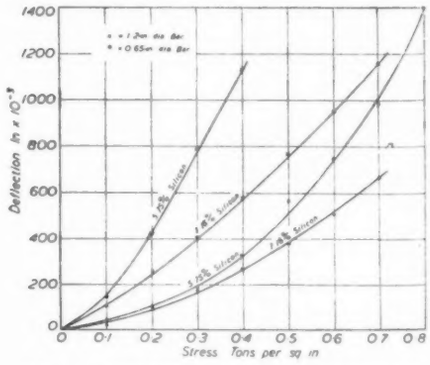


FIG. 7.—DEFLECTION OF BARS OF DIFFERING SILICON CONTENTS, SERIES *D*, AT 850 DEG. C.

These tests show that, for the same composition, a cast iron with coarse graphite has less resistance to deflection at high temperatures than an iron containing fine graphite. Both silicon and phosphorus increase the stiffness of coarse-graphite cast irons at the temperature of the tests. An examination of the structures of the bars in the preceding series, however, in relation to their rigidity and composition, shows that small differences in graphite size are un-

(*Continued on page* 24.)

Foundry Technique in the Production of High Strength and other Types of Alloy Grey Iron Castings*

By A. E. McRAE SMITH, M.A.

[*Abstract*]

This Paper consisted essentially of the material given by the Lancashire Branch as published in FOUNDRY TRADE JOURNAL, March 20 and 27, 1941, but was further augmented by additional details concerning some of the more important points, such as methods and compositions to be adopted to meet the new specification B.S.S. 786, Grade IV, and difficulties encountered in using high phosphorus cast irons for complicated castings. The author also emphasised the importance and utility of the nickel molybdenum cast irons as a ready and comparatively simple means of meeting the higher mechanical properties required by the new grade IV specification. He stressed the fact that cupola melted cast irons of this type were particularly easy to handle, and invariably show mechanical properties very considerably in excess of the minima called for in B.S.S. 786, Grade IV.

In conclusion, he warned foundrymen that close attention must be given to foundry technique in order to ensure complete soundness of structure and freedom from liquid shrinkage defects in all parts of every casting whether the material is a high-strength cast iron or otherwise.

These additional items set out below should be considered in conjunction with the original Paper as already published.

B.S.I. Specification for Cast Iron

The iron foundry trade has made great efforts during the last few years to bring about improvements in the properties of grey cast iron, and more especially to produce a series of products of consistent quality. Every possible means of improvement has been studied, but special attention has been paid to obtaining higher strengths, coupled with greater uniformity of structure in castings of complicated design and where widely divergent sectional thicknesses are exhibited in one and the same casting.

The B.S.S. for general iron castings No. 321 drawn up in 1928 enumerated two grades, the highest minimum tensile strength being that called for in Grade C, namely, 12 tons per sq. in. on 0.785 in. dia. test bars as cast, the corresponding figures for 1.2 in. and 2.2 in. dia. test bars being 11 and 10 tons respectively.

During 1938 a new British Standard Specification 786 was issued to cover high-duty cast irons. This specification detailed three grades of high-duty cast iron, the highest grade, number III, calling for a minimum tensile strength of 22 tons per sq. in. on 0.785 in. dia. test bars, with corresponding values of 18 and 15 tons from Grades II and I.

Although for several years previously alloyed and special process cast irons had been used to meet specifications calling for over 22 tons per sq. in. tensile strength, the issue of this new B.S.S. specification did much to bring high-strength cast iron to the notice of engineers. It is interesting to note that 786, Grade III. calls for nearly double the highest strength called for only 10 years previously. Of course, this does not mean that cast irons of higher tensile strength were not being made in 1928, but until 1938 there was no British Standard Specification which could be quoted. A still higher strength grade has recently been added, namely Grade IV, with a minimum tensile strength of 25 tons per sq. in. on the 0.875 in. dia. bar.

The question immediately arises in any gathering of foundrymen, what is the best, easiest, and most economical method of meeting these specifications for any particular application, and what are likely to be the founding difficulties. During more normal times when choice of raw materials is almost unlimited there are, comparatively speaking, very few real difficulties, but at present choice of raw materials tends to be somewhat limited.

Broadly speaking, the easiest and most reliable method to produce castings to meet B.S.S. 786, Grades II and III and IV, is by the use of alloy additions to base compositions, in which the various elements are suitably controlled and for the two higher grades it is usual to make use of processed cast irons. By that it is meant processed in the liquid condition and not by after treatments, such as quench and temper methods. For the high strength cast irons this usually entails the use of comparatively low phosphorus materials and, in the case of Grade IV, probably quite low phosphorus contents.

Hematite and other low phosphorus pig-irons, and even medium phosphorus pig-irons of the true Scotch type, together with refined irons, are in short supply, as far as the ironfoundry trade is concerned, therefore this has led to much consideration being given to choice of basic raw materials for all iron castings being made to comply with the requirements of the higher specifications.

Simultaneously with this, there has been a greatly increased demand for high strength iron castings for special applications, in many cases as a supplementary material to replace steel castings and forgings where a non-ductile material is suitable, provided its other physical properties such as resistance to impact, toughness, etc., are satisfactory.

Meeting Modern Requirements

In order to meet B.S.S. 786, Grade II, consistently the use of alloy cast irons of suitably controlled composition has been widely accepted. In the same way it has been found necessary to make use of special process and alloy cast iron to obtain a tensile strength of 22 to 24 tons per sq. in. to meet the requirements of Grade III. As already indicated, foundrymen now have to be prepared to meet a still higher grade with a minimum tensile strength of 25 tons per sq. in. on the 0.875-in. dia. test-bar as cast. In practice this means that average figures of 26 to 28 tons per sq. in. must regularly be obtainable in order to allow for a reasonable margin of strength above the absolute minimum. To-day alloy cast iron with a tensile strength of 28 to 32 tons per sq. in. in the as-cast condition, *i.e.*, without any after process such as heat-treatment can be regularly produced in any foundry possessing a reasonably modern cupola furnace if full use is taken of the alloys available.

Before dealing with types of cast iron and ranges of composition in alloy and special process cast irons in detail, it may be worth while to consider for a moment the main reasons for adding alloying elements to cast iron and consider the broad tendencies exhibited by various commonly recognised elements either used singly or in a variety of combinations. The main alloying elements used are nickel, copper, chromium, molybdenum and less frequently vanadium, titanium, aluminium, boron, etc., together with silicon and manganese when used in amounts considerably greater than normally found in cast iron. Nickel, copper, chromium and molybdenum are the elements most frequently used to give increased strength to the matrix of cast iron used either singly or in various combinations.

Use of Alloy Additions

Better to appreciate the influence of alloy additions to cast iron it may be useful to consider very briefly the structure and constitution of cast iron. Cast iron is essentially an alloy of iron and carbon in which the greater part of the carbon separates in the form of graphite and a smaller proportion, generally ranging from 0.3 to 0.85 per cent., remains combined with the iron in the form of iron carbide. If the graphite flakes were absent, the strength of any cast iron would be equivalent to the strength of the matrix and alloy additions would bring about changes in physical properties such as tensile strength, very similar to that ruling in alloy steels. This, of course, is not true since all types of grey cast iron, whether alloyed or not, contain free graphite and it is obvious that the graphite particles possess practically no tensile or shear strength. Therefore the ultimate physical properties exhibited by a cast iron having any particular type of matrix structure will depend on the amount, size and distribution of the graphite flakes, since cast iron acts in many respects as though the graphite flakes were a series of voids in the metal.

Alloy additions produce two distinct effects in grey cast iron. In the first place they will act in such a way as to accelerate or retard the graphitisation process and to vary the size and shape and distribution of the graphite. In the second place alloying elements when added to cast iron may also produce a beneficial effect on the matrix by alloying directly with the iron constituent. Speaking very broadly, most of the alloy additions, all other conditions, such as base composition, rate of cooling, etc., being equal, tend to yield stronger, harder and more dense matrix structures.

Both the above tendencies produce changes in the physical properties, and much research work has been done in recent years to make the greatest use of this in order to obtain easily controlled methods of greatly enhancing the quality of grey cast iron.

Briefly, the alloying elements may be classified into two main groups, namely, chill or carbide inducing elements and graphitising or chill restraining elements. The chief chill-inducing elements are chromium, vanadium and boron. These elements, by reason of being very powerful carbide formers, increase chill, stabilise carbides and refine and harden the matrix in pearlitic cast irons.

Chill-Restraining Additions

The chill-restraining elements most commonly used, apart from carbon and silicon, are nickel and copper, the latter only within the limits of its solubility. These two elements also refine and strengthen the pearlitic matrix. Other graphitising or chill restraining elements are aluminium, titanium and zirconium. Of these, aluminium acts like carbon and silicon, in that it produces ferrite and softens the matrix and also coarsens the graphite structure.

On the other hand, titanium, although producing ferrite with its softening effect on the matrix, when used in small quantities, particularly when oxide is present, strongly refines the graphite structure. Like aluminium, this element is also used on account of its deoxidising pro-

* A Paper presented to the London Branch of the Institute of British Foundrymen, Mr. Barrington Hooper, C.B.E., presiding.

High Strength and other Alloy Grey Iron Castings

perties, and is very useful for that purpose, but both must be used with great discretion and normally only in small quantities, since bad effects are brought about by their indiscriminate use. In passing, it may be mentioned that titanium additions, while certainly refining graphite structures, may under certain circumstances lead to the formation of so-called "sooty" fractures, with weak dendritic graphite patterns, a subject which will be dealt with later in connection with the production of the highest strength grey cast irons.

Special Rôle of Molybdenum

In addition to the above, there is one other extremely important alloying element, namely, molybdenum, which has been described as neither a graphitiser nor a strong carbide former. Molybdenum is mainly used to increase the strength and shock resistance of cast iron, since its addition exercises a direct solid solution effect in the ferrite, a refining action in the matrix and an improvement in the size and distribution of the graphite.

The most striking improvements in the production of high-strength tough cast irons have been brought about by taking full advantage of the beneficial effects of combinations of nickel and molybdenum on the physical properties of grey iron.

In order to meet the requirements of engineers, foundry metallurgists have made use of the tendencies indicated above to promote the following properties in cast iron, *viz.*:—

(1) Uniformity of structure, particularly in castings of widely varying sectional thickness.

(2) Better physical properties, including higher tensile and transverse and compression strength and resistance to shock, etc.

(3) Improved wear resistance.

(4) Improved heat resistance.

(5) Improved corrosion resistance.

(6) Improved machinability when correlated with any or all of the above improvements.

(7) Reliability and uniformity of output, etc.

Cast irons of higher strength and shock resistance, being of most general interest to foundrymen and engineers, will be discussed in detail, but special-purpose alloy cast irons prepared particularly for their wear, heat and corrosion resisting properties, will be excluded.

Current Practice for Meeting B.S.S. 786

The usual method adopted by foundrymen to meet B.S.S. 786, Grade II, is to use a base cast iron of suitably controlled composition, with the addition of nickel and/or copper in quantities varying between 1 and 2 per cent. nickel is normally preferred to copper since the solubility of copper in cast iron is strictly limited and in practice is often erratic. Provided the total carbon content of the base iron does not exceed 3.2 per cent., there is little difficulty in meeting the specification of 18 tons per sq. in. minimum tensile strength. Such cast irons may have a phosphorus content of up to about 0.6 per cent. without experiencing any considerable loss in tensile strength, but their shock resistance as measured by single blow impact tests will gradually decrease as the phosphorus content is increased.

Although the middle grades of processed cast iron such as Meehanite cast iron, Grade C, mostly without alloy additions have mechanical properties sufficiently high to meet this grade, low nickel cast irons in this category exhibit extremely good machining qualities, take a high quality finish and are generally foolproof. Furthermore, they can be produced in any foundry without special equipment and with very little metallurgical control. Their wear resistance is also good, but this can be further improved by the addition of chromium in the ratio of 0.5 per cent. chromium to 1.5 per cent. nickel, but usually at the sacrifice of some degree of machinability.

With regard to actual uses, cast irons to meet B.S.S. 786, Grade II, are being used generally for medium duty applications, such as machine tool castings of the highest quality, pressure-tight castings, automobile and diesel engine castings, and a host of other castings where uniformity of structure, moderate strength, machinability and wear resistance are required coupled with reliability and ease of production in any foundry.

In order to meet the requirements of Grade III, 22 tons per sq. in. minimum tensile strength, the same type of cast iron, *i.e.*, with 1 to 2 per cent. nickel, with the addition of 0.3 to 0.5 per cent. molybdenum, is useful, particularly where comparatively small tonnages are required in foundries lacking the necessary metallurgical control for the production of the processed types of high-strength alloy cast iron.

The production of these special process cast irons such as Ni-Tensyl iron and the highest grades of Meehanite are governed by British patents and therefore it is impossible to give exact details of foundry methods. It will be sufficient to indicate that the processes are based on the use of high steel charges followed by late applications of graphitising agents such as ferro-silicon, calcium silicide and other graphitising agents.

In cupola practice, the amount of steel scrap used—usually upwards of 50 per cent.—together with the technique of melting, controls the amount of total carbon in the resulting cast iron, the amount usually being in the range 2.6 to 2.9 per cent. The late addition of suitable graphitising agents also controls the size, arrangement and distribution of the graphite flakes.

Meeting Grade IV with Pseudo Austenitic Irons

Amongst Grade III materials Ni-Tensyl iron in particular is being very extensively used where tensile strengths in the order of 22 to 26 tons per sq. in. are required with some increase in shock resistance over good class engineering cast irons. As a material to replace and supplement steel castings and forgings it has been used for some very interesting applications. When alloyed with a small percentage of molybdenum in the range 0.3 to 0.5 per cent., its strength and shock resistance can be considerably increased and will achieve the mechanical properties appertaining to Grade IV with a minimum tensile strength of 25 tons per sq. in. These grades with a tensile strength in the range 22 to 26 tons per sq. in. may be described as the general utility high-strength cast irons. The matrix in the as-cast condition usually consists of very fine pearlite. Although it is not uncommon for such materials to exhibit Brinell hardnesses up to 300, they are quite readily machinable and their wear resistance is good.

Standard compositions may be modified to meet special requirements; for example, for highly stressed gears required to have both strength and wear resistance. Nickel-chromium-molybdenum Ni-Tensyl irons are in many cases very suitable.

The range of application of Grade III and Grade IV alloy cast irons, particularly Ni-Tensyl iron, is too wide to give in detail, but it will be sufficient to indicate that they are being regularly used for motor vehicle castings, diesel engine castings, etc. Nickel-molybdenum Ni-Tensyl iron is particularly suitable for pistons, cylinder heads and cylinder blocks in high-speed supercharged types of diesel engines. Often strength and wear resistance have to be coupled with freedom from any risk of picking up or galling under very severe conditions and with extremely limited clearance tolerances under high-speed lubricated rubbing conditions. Other important fields of application are for dies, gears, hydraulic castings, air and gas compressors, highly stressed components of special process plant such as mechanical, hydraulic and pneumatic presses, frames of tools such as steam and compressed-air hammers, stone crushers, etc. One great advantage to the engineering trade is the comparative ease with which Ni-Tensyl iron and similar irons may be cast into complicated designs without after-treatment, thus ensuring speedy deliveries.

They do not exhibit the same degree of liquid shrinkage porosity difficulties in unequal sections as is experienced in the production of steel castings. Hence their immense value to the engineering industry under present conditions.

Industrial Applications

Recent evidence of their usefulness to replace steel castings and forgings where a non-ductile material is suitable, is forthcoming from a section of the machine tool industry handling special purpose lathes. Ni-Tensyl irons, particularly those with small molybdenum additions and meeting the requirements of Grades III and IV, are being used extensively for such components as headstock spindles, helical tooth driving gears, sliding gears, tool holders, spindle couplings, forming and profiling cams as well as horizontal tailstock and collet cylinders in hydraulically operated lathes. These components would normally be made from steel forgings or in the case of the hydraulic cylinders from gunmetal and similar copper alloys.

The new Grade IV specification has recently stimulated much additional interest in the use of high-strength cast iron, particularly when a grade can be obtained which has normal properties well in excess of the minima called for, and also has greatly increased shock resisting qualities. The Grade IV specification was suggested primarily at the instigation of engineers who require a still higher strength cast iron, mainly for applications where a non-ductile material will replace or at least supplement the use of steel components.

Suggested Methods

When contemplating the best method to be adopted to meet this highest cast iron specification, it must be remembered that, when dealing with the range over, say, 24 tons per sq. in. tensile strength, each additional ton of strength specified is more difficult to achieve than when dealing with the range 12 to 20 tons per sq. in. One method is to apply normal quench and temper heat-treatments to Grade II and Grade III cast iron, but this process is outside the scope of the large majority of foundries, particularly even the best jobbing foundries. It is not readily applicable to any but relatively simple designs of castings, such as bushes, liners, gear blanks, etc. One would not willingly attempt to heat-treat by quenching methods complicated castings such as automobile and diesel engine cylinder blocks and cylinder heads for obvious reasons. All high strength castings benefit, of course, from low temperature stress-relief heat-treatment.

Although molybdenum bearing Ni-Tensyl iron will meet the minimum requirements of the new specification, nickel-molybdenum cast irons of somewhat higher alloy contents should prove very attractive to the iron foundry and engineering trade as a reliable method for obtaining really high strength cast iron capable of being produced from cupola melted metal.

An Ultra-Strong Iron

When discussing the individual influences of alloying elements on cast iron, it was observed that molybdenum is neither a graphitiser nor a

High Strength and other Alloy Grey Iron Castings

strong carbide former, yet it exercises a profound influence on the shape and distribution of the graphite flakes as well as refining and strengthening the matrix to a marked degree. Additions of molybdenum up to about 1.5 per cent. bring about a very substantial increase in the tensile strengths of cast irons of suitable base composition. Advantage of this property has been taken for a number of years, but recently more attention has been paid to nickel-molybdenum cast irons, with alloy contents of 1.5 to 3.0 per cent. nickel and 0.7 to 1.0 per cent. molybdenum. In fact, various authorities have shown that suitable combinations of nickel and molybdenum produce the maximum beneficial effect on the properties of true grey cast iron so far observed.

This effect combines high tensile strength, transverse strength, and deflection with intermediate hardness values (up to 350 B.H.N.) and outstanding machinability in relation to strength. Their resistance to shock is much in advance of anything previously achieved for grey cast irons with normal carbon contents. This type of cast iron depends for its properties on the formation of partially or wholly acicular or pseudo martensitic structures. They can be produced in routine practice with tensile strengths of 26 to 35 tons per sq. in. in the total carbon range 2.8 to 3.0 per cent., and are therefore readily produced from cupola melted metal.

Much lower total carbon contents were at one time considered to be essential to obtain castings with tensile strengths considerably less than this, and electric furnace irons held the field as being the ultra-strong cast irons with total carbon sometimes as low as 1.8 per cent. and bordering on the steel castings range. Here one is dealing with high-strength cast irons with a minimum carbon content of, say, 2.6 per cent., and in most cases not under 2.8 per cent.

The Acicular Structure

Acicular structures are a function of molybdenum, yet straight molybdenum cast irons have not been very popular. So far as present knowledge goes when dealing with cupola melted irons 1.0 to 1.5 per cent. molybdenum is necessary to produce an acicular structure in cast iron with a carbon content of 2.8 to 3.0 per cent., silicon being adjusted to suit the mass and sectional thickness of any particular type of casting. When 1.5 per cent. nickel is present the molybdenum content may be reduced to 0.7 per cent. for normal section castings up to, say, 1½ in. thick. Above that the nickel must be increased as the sectional thickness increases, but care must be taken not to over-alloy the material with the formation of true unmachinable martensite.

Practical Applications

So far most of the practical applications of acicular-structured nickel-molybdenum cast iron has been confined to rather lumpy thick section castings, particularly in connection with a variety of types of hot heading and forging dies and sleeves for specialised work. In these castings the alloy content, always assuming the carbon content is in the range of 2.8 to 3.0 per cent., must be regulated to the cooling rate and mass of the casting and not to test bars being cast with the job. For example, test bars of the 2.1 in. dia. or 1.6 in. dia. sizes may be martensitic, with a given alloy content, yet solid castings of 5 to 10 in. diameter can be fully acicular and machinable when poured from the same ladle of metal if the alloy content has been adjusted to the mass of the castings, and consequently is too high for the test bars.

A typical composition for castings over 1½ in. sectional thickness would be as follows:—T.C, 2.8 to 3.0 per cent.; Si, 1.8 to 2.8 per cent., according to mass of casting; Mn, 0.8 to 1.2 per cent.; S, 0.12 per cent. max.; P, 0.20 per cent. max.; Ni, 1.5 to 3.0 per cent., according to mass of casting; Mo, 0.7 to 0.9 per cent.

It will be noted that the phosphorus content is given as very low. This type of cast iron on account of its high strength and extreme toughness has been found extremely useful for hot pressing and forging dies, highly stressed sliding gears, crankshafts, camshafts, levers and numerous heavily stressed components. Even when the carbon content is increased to 3.3 per cent., as may happen under certain cupola operating conditions, tensile strengths over 28 tons per sq. in. will be maintained, provided the alloy content is adjusted to the mass of the casting. Its wear resistance is extremely good, and these properties appear to be retained up to quite heavy sections.

Limits of the Phosphorus Content

It has already been strongly emphasised that increase of phosphorus from, say, 0.3 to 0.7 per cent., or even 1 per cent., does not greatly reduce tensile strength in pearlitic cast irons (other considerations being equal), but this increased phosphorus does increase or widen the freezing range, at the same time lowering the temperature at which solidification commences. This extension of the freezing range does make such irons more difficult to handle in the foundry, for the production of complicated castings. A useful analogy may be taken from the founding of phosphor bronze. An alloy containing 10.0 per cent. tin and the balance copper has been stated to have a freezing range of approximately 140 deg. C. (1,000 to 860 deg. C. for complete solidification), whereas the same alloy with 0.5 per cent. phosphorus will have a freezing range of approximately 340 deg. C. (980 to 640 deg. C. for complete solidification). It is well known how difficult it is to produce sound castings of heavy section in this type of alloy in sand moulds. This is due to the long solidification period or wide freezing range, and to produce sound castings in this alloy it is essential to obtain rapid freezing by the use of chill or centrifugal casting methods.

Although the changes which have taken place in cast iron during the solidification are somewhat different and are also dependent on the carbon and silicon contents, it does show that the same main principles apply. With high-phosphorus cast irons, different methods have to be adopted to reduce porosity troubles compared with low phosphorus cast iron. These include extensive use of denseners, but far too often a passable looking casting is produced by means of puddle or rod feeding. This method naturally fails where pressure-tight castings of complicated design are being produced. High phosphorus, of course, is not detrimental to attainment of solidity if adequate feeding facilities can be provided, such as by means of self-feeding heads, progressive solidification, etc.

Unfortunately, the degree of liquid shrinkage tendency produced by phosphorus increments so far cannot be estimated accurately. Most of the various tests, such as the K-test piece and the dumbbell test piece, although useful in their own sphere, have not proved of great value to the practical foundryman. One design of test block which has not received sufficient attention is that suggested by Mr. P. A. Russell. It consists of a solid block, 4 in. by 3½ in. by 3 in. deep, and presumably cast with a standardised runner and without any form of riser. Two holes are drilled 2½ in. deep by 1¼ in. dia., leaving a wall of metal $\frac{1}{16}$ in. deep at the nearest point. One hole is drilled and tapped to take an adaptor for the application of a pressure test to the internal wall.

High Phosphorus and Moulding Technique

Moulding and core making practice for the production of high-strength alloy cast iron varies little for that adopted for ordinary grey iron being used for similar applications. Far too often the extra cost of feeding heads, moulding methods, fettling costs, etc., are cited. This is not strictly true since a very high percentage of all castings made in high-strength cast iron are of the machined all-over type, and in a great many cases require to possess a high degree of pressure tightness. Again, many such castings are heavy and massive, for instance, to take a very simple example, all types of dies. If these castings were made in common grades of phosphoric cast iron, to ensure complete freedom from liquid shrinkage defects, the same precautions would have to be taken, and even then the result would be hopeless because they would not be suitable for deep machining in heavy sections and would vary in structure from the skin so rapidly as to be useless. This is apart from all considerations of lack of strength.

Definite Recommendations

Consequently in producing castings in high-strength cast irons attention must be given to achieving complete soundness in all parts of every casting. Many methods and combinations of methods are used to obtain this, but they must all have as their primary object the equalisation of cooling rates in parts of varied thickness, or, in other words, they must aim at progressive solidification. The commonest methods employed are:

(1) Suitable distribution of runners to superheat the thin sections and so retard the cooling rates, and also keep the hottest metal away from the heavy sections. Moulds should also be filled uniformly, so that there is no tendency to create a hot and a cold side to the casting during cooling. For example, flat circular castings should always be run with ring type runners with ingates equally distributed round the castings, or in other cases be run from a central point. Long cylindrical castings should invariably be run from the top, with the addition, when absolutely necessary, of auxiliary or rather initial bottom running to provide a cushion or buffer for the stream of metal from the main hot runners. It is very bad practice to run such castings from the bottom only because the bottom of the castings and mould surface thereat is being superheated. Instead, top runners should be used to promote progressive solidification from the bottom upwards.

(2) Progressive solidification may also be encouraged by the use of suitable external denseners.

(3) In lumpy, heavy section castings, self-feeding heads of correct design and bulk are very effective, although they may entail extra cost in removal and remelting of surplus metal. This feature of increased cost has unfortunately been grossly over-stated by engineers and machine shop executives. After all, it does not cost any less to part off a short straight feeder than it does to remove a correctly proportioned feeder.

(4) Precautions should be taken to ensure ample rigidity of the mould and core structure in such a way that resistance is offered to the expansion which takes place prior to solidification due to graphite formation. This, of course, must be tempered with discretion to avoid hot tears and cracks.

(5) In many cases so-called steam-feeding may be used with advantage.

(6) Small parallel risers should be rigidly avoided. By all means use pressure relieving poppers or whistlers on the highest points, but do not use other types of risers which will solidify long before the portion of the casting directly beneath has set. How often in all kinds of grey iron castings does one find

(*Continued on page* 30.)

Maintaining Economic Prices

Mr. TEMPLETON'S ADDRESS TO LONDON FOUNDRYMEN

A meeting of the London Branch was held at the National Liberal Club, Whitehall Place, London, on July 3. The chair was taken, during the earlier part of the proceedings, by the retiring Branch-President, Mr. Barrington Hooper, C.B.E. Apologies for absence were announced from Mr. Geo. Hall (chairman of the East Anglian Section), Mr. Lockwood, Mr. Delport, and Dr. Hunt. The minutes of the previous meeting were taken as read, and were confirmed and signed.

The BRANCH-PRESIDENT said this was his swan-song, and it was now his task—pleasing and sad—to introduce his successor, Mr. Templeton, although "introduce" was the wrong word to use, as Mr. Templeton was much better known to the members than he himself was. He had had two years in the chair, and he thought it would be agreed that they had been rather trying years, because it had been necessary to break the routine. There had been all sorts of upsets and disturbances, as was evidenced by the condition of the National Liberal Club premises, and these had prevented the Branch holding its regular meetings. However, there was one thing he was happy about, and that was in handing over to a worthier and better President than he himself had been, a man who was more *au fait* with foundry matters and certainly more expert in that connection. After all, although he had been elected President and had been very pleased to take on the work, his real job was newspapers, and his knowledge of foundry practice was almost confined to casting types. Nevertheless, he had been very proud to have occupied the chair during the past two years, and any services he had been able to render he had been delighted to do. In handing over to his successor, he asked the meeting to give Mr. Templeton a hearty welcome.

Mr. Templeton then took the chair and was cordially received.

Presidential Address

MR. R. B. TEMPLETON then addressed the meeting, in the course of which he said:—Mr. Hooper and Gentlemen,—I do not think it is necessary for me to say what a very great honour and a very great pleasure it is that I am able to address you as your President. Mr. Faulkner, on the notice announcing the meeting, said that I should deliver a short address, and I can assure you that it will be short.

The old adage of some people having greatness thrust upon them is very true in my case, because our friend Mr. Lockwood should now be doing my job here. I have also inherited greatness from our Past-President, Mr. Barrington Hooper, who has so ably carried on the affairs of the Branch during the past two years. I do not think any praise is too high for the way in which Mr. Barrington Hooper has carried on the work, nor for the devotion and time which he has given to the Institute's affairs since his election. That effort has been combined with his well-known charm and geniality which have created an atmosphere in which it has been a great pleasure for everyone to work with him. I feel I can very inadequately replace the loss, and my personal views are that Mr. Barrington Hooper should be asked to carry on. He started us on this war and he should have carried us through it. (Laughter.) However, it has been decided that I shall take his place, and I can only say that I will do my best and try and emulate him to some extent.

To the members of the Council we must pay tribute for the way in which they have supported the President and the attention which they have given to the affairs of the Institute, often at very great personal inconvenience. I am happy, indeed, that the loss of Mr. Lockwood as secretary, has been so ably replaced by Mr. Faulkner stepping into the breach, and as long as I have him at my side as guide, philosopher and friend, I feel sure that I shall not get the Institute's affairs into very much of a mess, and I hope, when I hand over to my successor, that we shall have made some measure of progress, even in these very difficult and dark days.

Future Meetings

This brings one's mind to the coming dark nights of next winter, and, as you know, we practically ceased our activities during last winter, and only a skeleton form of activity was possible on Saturday afternoons. These, for many reasons, were not altogether a success, and it will be of assistance to your Council and myself if the members would make some suggestions for the future, so that we shall have some guide in arranging our future programme. My own view is that we must carry on and not let the war interfere more than is absolutely necessary with our lectures and discussions, which are the life-blood of the Institute. I do feel that we must carry on, and I shall ask for comments on this matter later.

Present Difficulties

Our industry is undergoing a very severe testing period at the present time, and no one can deny that it has shown a resilience to the overload it has had to carry. Some of us may not have had such an overload as others, but all of us have striven to increase production under such adverse conditions as rising costs everywhere, inability to obtain suitable raw materials and also acute shortage of suitable man-power. These adverse conditions continue, and, may get worse before we are through the gate, but I feel sure that every possible effort is being made by the "Powers that be" to alleviate these conditions. After all, everyone knows that the foundries of this country are the raw material producers of all engineering, and in the foundries is to be found the first and narrowest bottleneck in war production. We have our various Associations and Federations, which help us in solving some of our difficulties, and recently you have seen an effort made to combine all the various branches of the iron-foundry industry under one governing body. This effort is still being made, and I hope it will succeed, for no one can deny the necessity for the aims and ideals which are behind this effort. I am not going to enter into the pros and cons about the formation of the I.N.C., but I will say that the ideals of co-operation and co-ordination of effort, which a united body embracing all branches or associations could promote, are vital to all ironfounders in this country. The general prosperity of the whole industry would be greatly improved by greater co-operation and co-ordination. In that way we should improve our lot, and heaven knows we need it!

Pooling Information

I belong to a group of manufacturers who, every year, meet and pool all their successes and troubles openly over the table. We discuss research Papers on management, foundry operation, metallurgical and sales problems, and I honestly can tell you that everyone comes away from those meetings having learned far more and profited far more by these discussions than he individually would have done if he had kept his greatest success under his hat.

The lectures and discussions of the Institute of British Foundrymen are efforts on similar lines, and we must increase and improve them wherever we can. It sounds very prosy to say "We can all learn something from someone," and it may be, but the fellow who always thinks himself cleverer than the next man is, in my opinion, a purblind fool. It is by a better spirit of mutual help to each other that we shall improve our product and be more prosperous, and do not forget that the prosperity of any industry is not reflected by the prosperity of part, but by the whole, of that particular industry. The not-so-prosperous parts of any industry try to keep going by accepting prices which are not economic, thereby affecting the general price level of a particular product, and retarding the prosperity of the whole.

Avoiding Price Cutting

You will say these are fine words, but how can we put them into practical use? My answer is:—(1) By being less suspicious of each other; (2) by making personal contact and getting to know each other better; (3) by allowing each other into our respective foundries and discussing our troubles; (4) by avoiding price-cutting; and (5) by passing on to others a job which we are not suitably equipped to make. I believe the time will come when orders will not flow in as they do now, and then our troubles will start, or increase. How often did we look at a decent inquiry in the old days in the following manner: "Here is a nice job which I can make at £30 per ton and show a margin of profit, but I feel that Jones or Brown will quote £28. I must therefore quote £27." But, by doing so, you are straightway making a loss, because the £3 per ton you have cut to get the job is your profit. But that is not the whole story, because in getting the non-profitable order you have probably jeopardised the possibility of obtaining from another source an order which would have been profitable by having to quote an intended delivery.

MR. V. C. FAULKNER, proposing a vote of thanks to the Branch-President, said he had dealt with a most important phase of the foundry industry, *viz.*, the employers' organisation. At the moment the whole question was in the melting pot. There now existed three major organisations, and it rather looked as if there was to be a fourth to look after the other three. All he could say was that he wished them all the same equal success in their new ventures.

MR. C. H. KAIN, who seconded the proposal, said that Mr. Templeton was manifestly the right man for the chair at the present time. He held strong views on the question of employers' organisation and if, during his year of office, he managed to achieve that very desirable objective, everybody would say that the new Branch-President had had a very successful year. Apart from all this, however, they would all be very pleased to sit under Mr. Templeton as Branch-President. He had been among them for some years and was thoroughly liked.

The vote of thanks was accorded with hearty acclamation.

MR. J. FERDINAND KAYSER, metallurgist to Gillette Industries, Limited, then gave a talk on "Mass Production and the Maintenance of Quality." There was an interesting discussion and a report will appear in a later issue.

Vertical Centrifugal Casting

Nathan Janco, a consulting engineer, of Tulsa, Oklahoma, in an article in "Metal Progress," discusses centrifugal casting with vertical axis. Until recently, he says, the use of centrifugal casting machines with vertical axis has been neglected without justification. He describes three methods, which he calls (1) true centrifugal casting; (2) semi-centrifugal casting; and (3) pressure casting.

Moulding a Bend Pipe Breeches' Piece

By J. H. WEST

The finished casting, a bend pipe breeches piece as shown in Fig. 1, is a very unusual shaped casting and therefore required a little more forethought than is customary. After some discussion between the manager, foreman, patternmaker and foreman moulder it was decided, for various reasons, to make the job as follows:—

First, the patterns, or tackle—as one of the members once remarked: "Through the layman's eyes it would look like a bundle of firewood"—had to be made. This tackle consisted of the items shown in Figs. 2, 3, 4 and 5, Fig. 2 being the strickle; Fig. 3 the joint frame; Fig. 4 the plywood template; Fig. 5 body and core strickles; and Fig. 6 the template and strickles for core iron.

With this tackle to hand, the moulder then proceeded to strickle out an impression of the core print, flange, joint and bed of the single-flanged end of the pipe, using the strickle shown in Fig. 2. This work was done at the bottom of a pit, which was the depth of the overall height of the job, when standing on the single flange (Fig. 7).

The strickle was then removed and the 2-in. diameter spindle left in position, and the job thus far was blackened and dried.

The moulder's next procedure was to lay a cast-iron plate as shown in Fig. 8 on to the back half of the bed. This plate, which the moulder made in an open sand bed with the aid of the strickle shown in Fig. 2, came close up to and half-way round the joint. The moulder then filled the remaining half of the bed, flange and print with sand, thus forming a new bed level. The joint frame (as shown in Fig. 3) to which is attached the bottom halves of the two top flanges, was then placed on top of the new sand bed and located by passing the 2-in. hole in the tie strip over the spindle and keeping the flanges parallel with the centre line, which the iron plate formed on the bed.

After the frame was stacked and the tie strip removed, it was rammed up with sand and strickled off, thus forming a block of sand with the curved surface being the actual joint and centre line of the pipe along the line X-Y (Fig. 7). The plywood template (Fig. 4), which was cut 1 in. larger than the outside of the pipe, was laid on the curved surface of the sand block and being plywood was easily bent over the curve and held down flat against the sand by long nails driven into the sand.

Core strickle, item A (Fig. 5) was now used to scrape out a dummy corebox (Fig. 9) with the plywood template acting as a guide, and as there was no further use for the strickle shown in Fig. 2 it was cut off to core size and used for scraping away the sand through the flange and clearing the core print at the bottom.

The core iron was made in the following way:—Two moulds were made in an open sand bed using the template shown in Fig. 6. Into these moulds ⅜-in. diameter wrought-iron rods were pushed perpendicularly with half the length of the rods projecting above the floor level. The result was that after casting metal into the mould we had two castings with rods projecting through each side, and the idea was that if any of the rods projected too far out they could be bent, cut off or twisted into any shape required.

Now, the strickle in Fig. 6 was used to strike out a mould in an open sand bed, and the two irons already existing were set up on end in the mould by the patternmaker. Thus, when metal was cast into the mould, it set round the end of the two irons and formed a complete core iron with two horns and a disc, which was the exact size of the core print at the bottom end of the mould (Fig. 10).

The core iron was now placed in the dummy core box with the disc seating well in the core-print. The core was made in the usual manner by ramming sand into the half dummy box and moulding up for the top half and strickling off with body strickle B (Fig. 5), thus forming a sand pattern for the top half of the job. Then two wooden top-half flanges, which clipped over the body and met the bottom halves already embedded, were placed in position, and the sand beyond these flanges was scraped away to core size to form a sand print, thus making a perfect sand pattern for the top half of the job.

The moulder then proceeded to mould this top half by placing bricks and loam on the cast-iron carrying plate and working up to a little over half way, so as not to go over balancing point. Then an ordinary flat moulding box to which was attached a grid was placed over the job on the floor level and stacked round the edge of the pit. The grid which was made in the usual manner hung down over the pattern. It was then an easy matter to ram up the remaining half of the job with only the grid and the centre portion of the box filled with sand.

The top half of the mould was then taken away in two pieces. The moulding box was lifted in the usual way and the remaining portion was lifted by hanging the bottom cast-iron plate at three points, lugs being provided for this purpose. With the top half of the sand pattern exposed, the next operation was to strickle it off to core size and then lift out the whole core by simply hanging it at three points, namely the projecting horns and an eye bolt screwed into the bottom core plate. This eye bolt was easily found by cutting away a small hole in the core and patching up afterwards.

It only remained now to strickle the thickness of metal out of the dummy core box, drawing out the wooden flanges, and scraping away the sand in the bottom flange, and we had the mould for the bottom half of the job. The core and then the two top portions were replaced, the pit rammed up with sand, and the job was ready for casting.

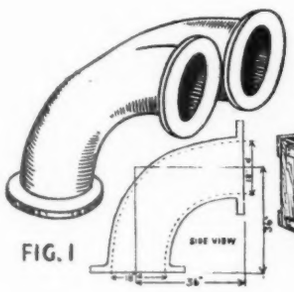


FIG. 1

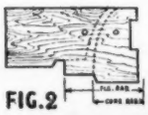


FIG. 2

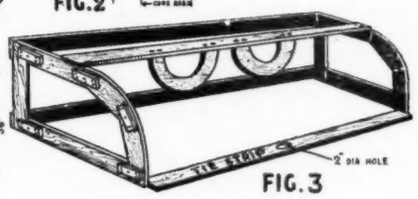


FIG. 3

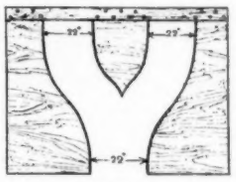


FIG. 4

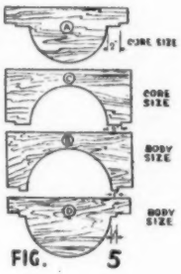


FIG. 5

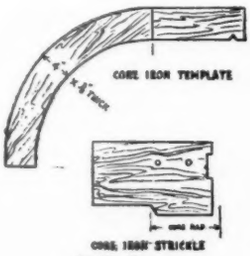


FIG. 6

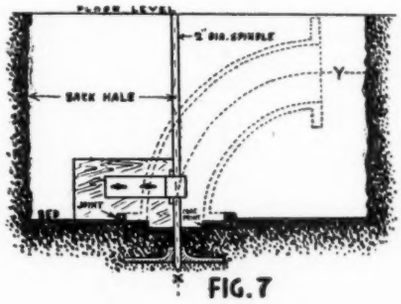


FIG. 7

FIG. 8

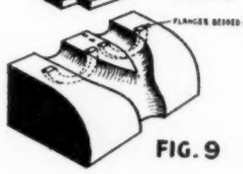


FIG. 9

FIG. 10

Discussion

A MEMBER pointed out that it often occurred that the cross-sectional area of two outlets or inlets had to be the same size as the main body of the pipe. Supposing that the two branches were, say, 10 in. and the main body of the pipe 16 in., what would Mr. West suggest?

MR. WEST agreed that the casting described in his Paper had a peculiar shape. It was unusual for the two branches to be the same size. He thought that difficulties caused by differences in size might be overcome by striking out the two branch pieces in the ordinary way and adopting a larger strickle for the bottom position. Before cutting out the actual thickness,

* A paper read before the South African Branch of the Institute of British Foundrymen.

small bosses could be embedded in order to ensure an even thickness of metal throughout.

MR. PETERSEN wondered how many patterns could be found along the Reef which had been used once and would never be used again. It occurred to him that, if sufficient thought were more commonly given to the job, a surprising number of patterns could be avoided. In cases where there was only "one off" consideration might be given to the possibility of finding a short cut and saving the expense of a pattern.

Economics of Patternmaking

MR. BRAGG said that, in his opinion, there was a tendency on the Reef to think too much of the expense of making patterns. He recalled a particular job which had been made about nine years ago from a rickety old skeleton pattern that took 56 hrs. to mould. The job weighed perhaps 1,500 to 1,800 lbs. A few months ago he had an inquiry for four similar castings. The pattern was still in existence and had been used a number of times by different firms. His company tendered for the job and was successful, whereupon he decided to make a pattern. It took him about 50 hrs. to make the pattern. With it he produced castings in 20 hrs. instead of 56, and the pattern was there for all time. In the production of the second casting the cost of the pattern was recovered, and much better castings were produced. He felt that there was a tendency to cut out the pattern at the expense of the foundry and the quality of the article.

MR. LION-CACHET was inclined to endorse Mr. Bragg's remarks. He pointed out that even when a right and left were needed, the patternmaker frequently made only one pattern, which was changed over from right to left as required. He believed that by making both a right-hand and a left-hand pattern considerable money could be saved.

On another point which Mr. Bragg had made, MR. LION-CACHET agreed that, when casting in steel, it was particularly necessary for a full pattern to be provided, because the moulder could then ram the sand harder. Moreover, in the steel foundry the carving ability of the moulder could not be relied upon to the same extent. He took the opportunity of congratulating Mr. West on what had been the best explained Paper he had heard for a long time. The method adopted was most ingenious.

Replying to Mr. Bragg, MR. WEST said he was of opinion that the day when patterns were not considered sufficiently was past. Competition was very keen, and every manager had to decide whether it paid him better to run an efficient patternshop or to rely on cheap patterns. Foundrymen were beginning to realise the significance of a good pattern when there were a large number of castings to be made, and were ready to go to considerable expense in order to obtain a perfect pattern.

"Good-Looking" Castings

MR. GUY said that Mr. West had raised an interesting question, but he did not agree that good-looking castings gave a foundry a good name. They had to persuade their customers to appreciate good castings and quality metal. At present there were no specifications, and there was no incentive to turn out a good-looking casting rather than one which merely served its purpose. If customers could be persuaded to appreciate the difficulties of foundrymen, much would be accomplished. Patternmaking was a big item in the expenses of an engineering shop on the Rand, and was out of all proportion to what it ought to be. However, with the limited market available, they had to please their customers.

MR. BRAGG said that he had been misunderstood. What he had in mind was that a cheaper and more efficient article could be produced with a good pattern.

MR. TONGE recalled that two or three years ago he had made a special plea for closer co-operation between engineers and foundrymen. His experience in the production of steel castings was that a rugged casting, if sawn up, proved to be a better casting than one which pleased the eye. He considered that customers should be brought to know what to expect from a steel casting and what from an iron casting. In regard to Mr. Bragg's contention that a good pattern was cheaper than a skeleton pattern, he agreed that in jobs which were repeated a number of times, the cost of a good pattern was repaid over and over again. At the same time, ingenuity was required when a job came along which was only "one up."

Co-operation Between Departments

A MEMBER was of opinion that, though much was said about co-operation, very little was done to bring it about. This led Mr. Holdsworth to state that from his own experience he could say that co-operation saved considerable money, as well as many headaches in the foundry after the job was finished. Mr. Cartwright considered that it was practically impossible to produce articles on a competitive basis without co-operation between departments.

MR. WEST considered that consultation should not be between the patternmaker and the moulder only, but also between the patternmaker and the foreman fitter. Many hours could be saved in the machine shop if the patternmaker had a full understanding of the job.

MR. LION-CACHET thought there must be general agreement that much money could be saved by co-operation between departments. There was also a need for closer co-operation with customers. Personally, he was very much in favour of castings used by the mines being changed, because it was only by changing existing designs that progress could be made. To his mind, it was right that a single engineer on a reduction works should have the power to alter a casting because it was out of the workshops that new ideas and improvements usually came.

A change in a particular pattern might cost a foundry a few pounds, but might result in an improvement of great value to the mining industry. It was difficult to draw any line as to the extent to which alterations should be made. Many of the improvements which had been brought about on the mines during the past few years had been due to individual workers.

Sometimes the speaker had the impression that a moulder could not read a drawing quite so easily as a machine-shop foreman. The individual moulder should endeavour to familiarise himself more with drawings in order to give the patternshop that service which was so essential.

Technical Education

MR. HOLDSWORTH considered that the system of technical education was not altogether satisfactory. He thought the Institute should force those higher up to give every youngster a good education. It was necessary for every man in every department of the engineering industry to be able to read a drawing.

MR. STONES disagreed with Mr. Holdsworth. He pointed out that at the Technical College every youngster was taught drawing, which was compulsory. The facilities were there, but he felt that the youngsters themselves had no time for them. How many moulders were able to explain how they wanted a pattern made? He was also of opinion that every manager should study patternmaking.

MR. TONGE endorsed the remarks of Mr. Stones, and declared that no blame could be attached to the technical colleges, which were as fine as those overseas. The trouble sometimes was with the apprentices themselves. The majority of foundrymen felt that the lads did not seek always to benefit from the facilities as their fathers had done.

MR. WEST was of opinion that a shop foreman could have a valuable influence on the apprentices, particularly if he singled out one or two of the most promising for particular attention. He should chat to the lads about their schooling and encourage them to use their brains.

MR. LION-CACHET made the point that when most members began their careers, there were neither motor bicycles nor cinemas. Nevertheless, he felt that the modern boy grew up as good a man as his father.

MR. HOLDSWORTH recalled that in Britain the patternmaker could frequently be seen going round the castings at lunch time, to see how his patterns were faring.

MR. BRAGG thought a moulder should not be expected to be so proficient at reading drawings as an apprentice fitter or turner who was working from drawings all the time.

The Psychological Aspect

MR. NIMMO DEWAR felt that psychology had to be considered. There was also a tendency to adopt the same pessimistic attitude towards the youth of to-day as our fathers did to us. It was possible that the young people of to-day might develop a line of thought which in future years would have unusual effects. Psychology was an integral portion of industry to-day. Moulding, in common with other industries, required intelligence and without men of ability the progress of the past few years could not have been accomplished. South Africa's industrial effort would have been considered impossible a few years ago, and he thought the industry should remember that it had got the workmen it deserved. If apprentices were treated fairly, difficulties were swept aside and the lads would not be found lacking.

Resistance of Cast Iron

(*Continued from page* 18.)

important and have less influence on resistance to deformation at the temperature of the test than relatively small changes in composition. It will be seen, for example, that bar 4, the structure of which is shown in Fig. 14, was more rigid than bar 3, with the structure depicted in Fig. 13. Here an increase of approximately 0.5 per cent. Si has more than offset the influence of the coarser graphite structure in bar 4.

In Series B, bar 10, with the structure shown in Fig. 20, was more rigid than bar 9 (see Fig. 19). A difference of 0.173 per cent. P has counteracted the effect of the coarser graphite structure of bar 10. An examination of the results obtained from the bars of Series D, however, shows that large differences in graphite size have a greater influence on rigidity than comparatively large differences in composition. It will be seen that bar 11A, having the structure shown in Fig. 21, was more rigid than bar 12B, which had the coarse graphite structure illustrated in Fig. 24, but which contained 1.2 per cent. more P. Bar 13A, with the structure shown in Fig. 25, resisted deflection more successfully than bar 14B, with the structure reproduced in Fig. 28, although the latter contained approximately 1.4 per cent. more Si.

(To be continued.)

Danish Foundries

Since the occupation of Denmark, the foundries in that country have experienced serious difficulties in obtaining raw materials, to overcome which O. Hoff in "Ingenioren" studies the possibilities of manufacturing synthetic pig-iron. Fuel supplies from Germany have been sporadic and have necessitated economies in consumption.

STANTON-DALE

Refined

PIG IRON

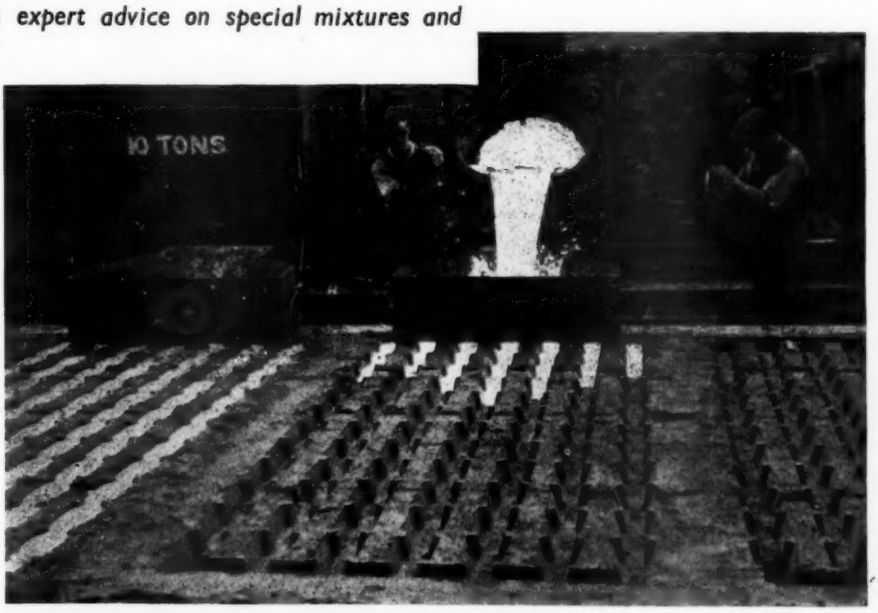
IS CHARACTERISED by closeness of grain structure, uniformity of composition and fine graphitic carbon evenly distributed.

IS PRODUCED to guaranteed analysis in seven standard grades.

CAN BE MADE to customers' individual requirements with total carbon from 2·6 per cent. upwards.

SHOULD BE USED to tone up high phosphorus irons and scrap, to replace Hematite, and to produce castings for all high duty purposes.

Users are invited to avail themselves of the Stanton Technical Service which offers free expert advice on special mixtures and other Foundry problems.



THE STANTON IRONWORKS COMPANY LIMITED, NEAR NOTTINGHAM

Core Trays and Packers

By JAS. TIMBRELL

Core carrying shells and packers, for the production of true-to-shape cores, have been mentioned on two occasions recently in the columns of the JOURNAL. The advantages gained from the use of this equipment cannot be overestimated, especially so in the case of cored out thin-sectioned jackets, ports, and the like. With jacket cores, any swellings or out-of-shape areas will cause uneven sections round the cylinder walls.

Perfectly true to outline cores, for intricate moulds, will save much valuable production time if the assurance is evident that sections will come out to correct dimensions on all out-of-sight spaces when assembling a set in place. Otherwise clay rolls have to be used to prove running thickness and chaplet sizes, if these be used. Upwards of 30 cores to a set are commonplace in certain types of multi-cylinder and crankcase castings, and it is with this type of intricate foundry technique that this article has been written, as a simple, accurate and least expensive way of developing this essential tackle.

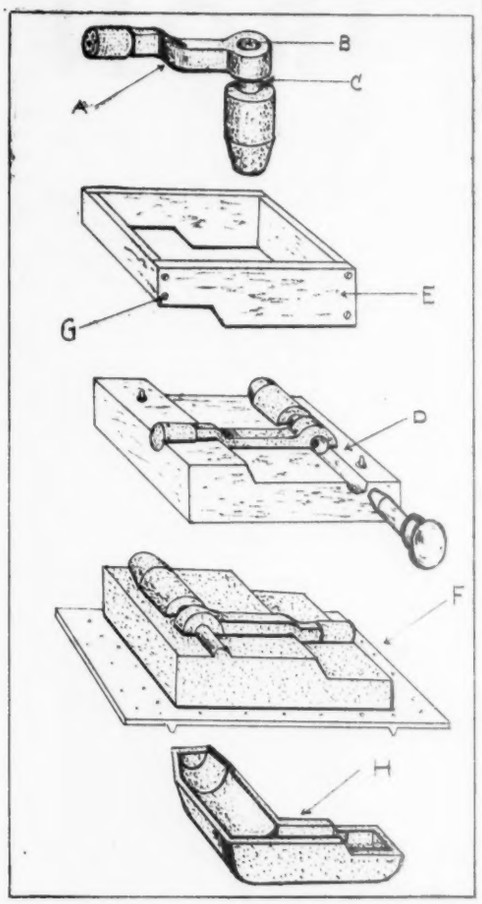


FIG. 1.—ELBOW CORE.

There are several ways of making negative shells and packers, as for example the use of plaster of paris; the hard, slow-setting media; cement and the patternmaker's replica in wood. This last one is naturally fragile, and sensitive to the foundry conditions, which are liable to create distortion by contact with the moulding sand.

Core sand—prepared as set out later in this article—and dried thoroughly, can be filed away to any reasonably required section and shape, clearances trimmed to suit and allowance for contraction, etc., easily added to develop into a master pattern. This material is strong enough for all practical moulding purposes for the number required off. Moreover, after impregnating as described, it will retain its correct shape and remain unaffected by the conditions which provoke distortion to wood patterns.

Another advantage from this sand patternmaking, any levelling bars or brackets, dowel and handling lugs can be filed up or attached.

Fig. 1 shows an elbow core, with an uneven joint line. B is the space which forms the valve-guide boss; C forms the valve seating; D is one half of the corebox with the rammed-up core in place. The core sand used for the process has a quick air-drying quality. The elbow core and corebox are set on one side in a warm place to harden out, and, when dried sufficiently, to withstand further ramming. The packer E—screwed together—is placed on the box and the packing rammed up on the same sort of core sand. The whole is then turned out on to a level core plate shown at F. The screws G are taken out, and the packer frame removed. The elbow core and packing block are then dried in the usual way.

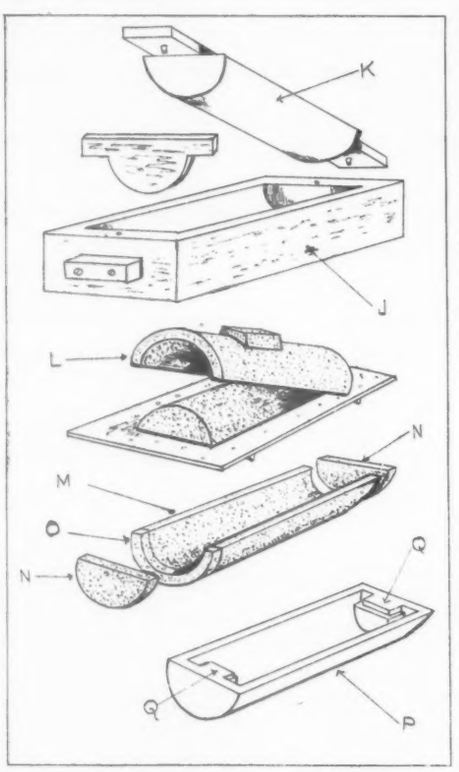


FIG. 2.—INTERNAL PACKER OF JACKET CORES.

After drying, the elbow core and packing are separated, and the packer block is filed away to even section all over, as shown at H. It should be noted that the valve guide boss and the valve seating have been removed, and also that two pieces have been stuck on the ends. Moreover, a small amount of clearance has been trimmed away on the diameter.

This master pattern in its present form would collapse under moulding conditions, so that it is necessary to add strength, resistance to moisture, and smoothness. Hard paraffin or beeswax is melted and painted on to the core, which has been preheated until the sand will not absorb any more. The core is then put on one side until cool. This treatment will render this pattern equal in many respects to wood, whilst another thin coat of beeswax applied after the first application has set makes a smooth face devoid of grain. A wipe over with a paraffin rag prior to moulding off will leave a smooth skin on the resultant castings made from it.

J (Fig. 2) shows the method repeated to make an internal packer for jacket cores. This has been drawn as a simple half-jacket, all incidental parts such as ports, bosses, etc., have been omitted, although these can be attended to in the same way as described. The jacket core is rammed up as before. The bedding in of block K forms the internal shape. The core and core box are put on one side to harden out; afterwards the packing is rammed in, levelled off, and the whole turned out on to a level plate and thoroughly dried.

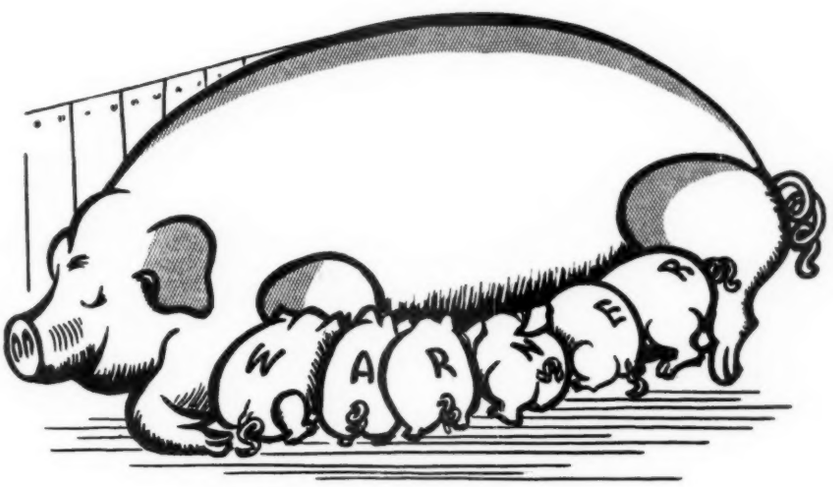
Separated, as shown at L, the dried packing block is trimmed away to even section M. Two end-pieces N are filed up and attached, after an amount O has been sawn off to bring the overall length to correct measurements. The moulders rap may be utilised to bring the diameter correct on the finished castings. P shows the finished pattern, and lifting in lugs may be added inside the finished job as shown at Q. A separate core box for these is made from the same type of sand.

Sand for this method of patternmaking should have the dual characteristics of good green-bond strength, and quick air-drying quality. The need for dried strength is obvious. A mixture that is satisfactory and will "tool" very satisfactorily is 3 galls. of damp sieved sea sand. 1½ pints of linseed oil or a proprietary brand of core oil, and 1½ pints of a starch binder. This is mixed to a stiff consistency in a mixer or by hand shovel and sieve. For trimming tools, all that is necessary are a few assorted files of not too rough a cut, with a safe edge one side, and a new saw blade. Good light will aid the production of sharpness and regular section to the finished article.

Blast-Furnace Rehabilitation

The subject of "Blast-Furnace Rehabilitation" was the theme of a Paper read by MR. J. H. SLATER, of the Republic Steel Corporation, Cleveland, Ohio, before the recent Annual Convention of the Association of Iron and Steel Engineers, and published in "Iron and Steel Engineer." The author dealt with the importance of foundations, of altering the existing design, particularly furnace volume, the handling of stock and coke, together with charging equipment. Stoves and gas-cleaning received attention, while reference was made to mechanism for regulating cold air to the hot-blast main, and to the centralisation of instruments for the convenience of the operator. Giving comparisons showing the improvement in operation due to changes in design, the author instanced a furnace which, before re-designing required 70,000 cub. ft. of blast per minute; output per day 950 tons; coke per ton of iron 1,925 lbs., and quantity of dust per ton of iron 250 lbs. After re-designing, the blast requirements amounted to 80,000 cub. ft. of air per minute; output of iron per day 1,125 tons; weight of coke per ton 1,838 lbs., and dust produced per ton of iron 153 lbs. Another furnace was greatly improved by providing 16 tuyeres instead of 12. In other respects the furnace was little altered. The quantity of blast before and (after) the change was 67,000 cub. ft. per min. (65,000); output per day 921 tons (1,003); quantity of coke per ton of iron 1,960 lbs. (1,762); quantity of dust produced per ton of iron 230 lbs. (160).

MIGHTIER YET . . .



Present day conditions call for an even larger range of Warner Pigs—in fact we wish we could litter our stock ground with them.

At any rate we are producing many analyses which, though they may not be so familiar to the Foundry Trade as our ordinary grades, are helping numerous firms to solve their war-time problems.

If we can help you, we help Britain to become "Mightier Yet" —that is our conception of war-time service.

Warner's

Special Pig Irons

WARNER AND CO. LTD., CARGO FLEET, MIDDLESBROUGH

Weight and Count

By "ONLOOKER."

Among the many problems that have confronted metal manufacturers since the war began, one of the most difficult and stubborn of solutions has been that relating to transport generally, and the handling in and out of the factories of consignments of metal. In the ordinary way weight and count of an incoming parcel of copper, lead or spelter are essential if records are to be accurately kept and suppliers' invoices properly checked, but there are times when it is not possible to achieve one of these desirable tallies. Provided that the count is obtained, some approximation of the weight can be secured by weighing over a beam scale perhaps half-a-dozen of the units comprising the parcel.

Given an accurate count some computation of the total weight involved may be obtained in this manner which should at least reveal any glaring discrepancy provided always that the pigs, ingots, slabs, etc., are uniform in size. This method is perhaps rough and ready, and certainly would not be accepted as adequate proof of weight in any dispute but if for any reason weighing during the period of delivery is found to be impossible, then it is the next best thing. In this connection it may be mentioned that parcels coming from the big overseas refineries are accompanied by weight certificates, which experience shows are very rarely if ever at fault even though the weighings may be in fairly large drafts.

The short days, when the black-out came by 6 o'clock or so, proved to be a difficult time, and operations after nightfall correspondingly troublesome. In any case, unloading without adequate illumination must at the best be a laborious, slow and even dangerous undertaking, so that to ensure efficiency, the vehicle, whether truck or lorry, must be taken in through a light trap and dealt with somewhere under cover. As a statement of what might be done this is all very well, but to put it into practice is another matter altogether, and in many cases, especially where warehouse space has perforce been sacrificed to make way for additional room for productive machinery, it may well be altogether impossible.

In these days of transport by road long-distance lorries may easily arrive at the black-out hour, and probably the only course left open is for the lorry to stand by until the morning brings the opportunity to get the load off. It may perhaps be submitted that transport should be timed on its journey so as to arrive in daylight with sufficient margin for disposing of the consignment before sundown, and generally speaking this is what is arranged, but inevitable delays occur on the way, and there is, of course, always the chance that some hold up in discharging at the works may lead to a jam at the discharging point. Nowadays it is wise if possible to allow a fairly generous margin for eventualities.

It is quite evident that in periods of hustle, when there is persistent pressure on manufacturers to turn out essential products in ever increasing numbers, first consideration must be given to the massing of personnel on the maintenance of output. This may mean economising on service departments, under which heading weighing may perhaps be put. An up-to-date efficiency can help in this problem, but adequate supervision is necessary in these days when very large vehicles and lorries with trailers are far from uncommon. On the whole, however, the weighbridge weight may be counted upon provided that close attention is paid to those details which are important in the operation of this type of scale.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Life of Monolithic Linings

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—I was very interested to read the report of the discussion at the January meeting of the East Midlands Branch in your issue of June 5, under the heading, "Quality of Foundry Refractories Criticised," particularly in its reference to rotary furnace monolithic lining material, having specialised in its manufacture and superintended lining installations for many years.

It may interest your readers to know that a 1-ton rotary furnace lined with a proprietary brand of monolithic refractory material and melting high-duty iron gave 220 melts without any repair whatever; moreover, when the furnace was taken off owing to some small mechanical defect of the casing (due in no way to the lining material), there were 6 in. of lining in very excellent condition, and it is safe to assume that, but for the necessary repair to the casing, the lining would have given at least a further 80 melts.

I think, therefore, your readers will agree that the manufacturer of this material can justly claim to have made such improvements in "monolithic" refractory material as will, under normal conditions, fully meet the requirements of rotary furnace users in the iron and steel foundry industry.—Yours, etc.,

M. NELSON.

"Lyndhurst," 12, Vainor Road,
Sheffield, 6.
June 18, 1941.

Foundry Labour

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—At the outbreak of war all industries were made aware that demands would be made upon their labour, and that they must be prepared to reorganise for production, using more women and a great deal of ingenuity to attain even greater efficiency than before.

The nature of foundry work, however, is such that the employment of women is a virtual impossibility. First, because they are physically incapable of handling a job of any real weight, and secondly, because even where reorganisation has sufficiently lightened the work, women will not accept employment in the turgid atmosphere of the foundry while they can find a job in more congenial surroundings.

Every foundry worker is, in some respects, a skilled man. Even the labourer who pushes sand around in a wheel-barrow must fit into the general atmosphere of the industry, and his ability to do his job satisfactorily is often the result of long experience in the foundry. Every foundry executive can discern a real foundry worker amongst his men as against the odd-job man from all and any industry who is often sent along by the Labour Bureau to-day.

The special type of labour required is probably comparable to that employed in the mining industry, and, in practice, it is usually found that the ex-mine worker makes the best foundry worker.

Paradoxically, highly mechanised foundries have probably been as hardly hit as any, for there the proportion of labourers to output is in a much greater ratio than in the jobbing foundry, and each man is performing an operation which is vital to the rest of the shop, and this without any reduction in the skill necessary to handle the work; in fact, many of these operators become highly skilled in the performance of their own particular task. Their general foundry knowledge is often very useful in watching for scrap at various points on the plant and reporting it.

From all this, it will be seen that the problems of labour in the foundry are special problems, and are confined to a very definite and small section of the community. If this fact were appreciated fully in official circles there could be much saving of effort in the allocating and engagement of men for the foundry.

When a request is made to the Labour Exchange for men, and the resulting applicants are well past their prime, and, not infrequently, with disabilities which they will tell you prevent them from doing any of the work for which they have been engaged, the people responsible for foundry output are liable to despair of the position.—Yours, etc.,

"FOUNDRY EXECUTIVE."

[Unless "Foundry Executive" means to exclude the core shop from his argument, we cannot agree with his contentions. We have during the last war teemed steel into moulds from ladles suspended from cranes driven by women. The scrap for the furnaces was barrowed from the yard to the furnace platform by women. A well-known foundry in Lincolnshire uses female labour for making cores as large as a cabin trunk. It must be admitted that this concern has been organising the system for several years, and it has been an outstanding success.—EDITOR.]

Powers of Ministry of Supply's Controller

Mr. Justice Farwell, in the Chancery Division recently, delivered his reserved judgment in an action in which John Fowler & Company (Leeds), Limited, a company controlled by the Minister of Supply, claimed as against the Minister, Sir Andrew Duncan, and the controller appointed by him, Mr. Charles Henry Crabtree, that an order made in March, 1941, appointing the controller was *ultra vires* paragraph (4) of the General Regulation No. 55 made under the Emergency Powers (Defence) Acts, 1939 and 1940. Assuming that the appointment was valid, the company claimed that the controller had exceeded his powers.

His Lordship, in giving judgment, said that the company were manufacturers of engines and, since the war started, had manufactured certain machinery. With regard to the second form of manufacture, all the contracts were in the hands of the Minister of Supply, who, in March last, under the Emergency Powers (Defence) Act, appointed Mr. Crabtree controller of the company's undertaking and directed him to exercise the functions set out in an Order made under that Act. The result of that appointment had been to produce considerable friction between the controller and the company. The company complained that their business had been hampered.

On the first point of the action, his Lordship said that the word "controller" in the Defence Act was one of very wide meaning and not limited in any way. It enabled the Minister to give the controller so appointed the fullest powers over the business, and it was impossible to come to the conclusion that the Order made was not authorised by the Act. Therefore, so far as that part of the relief claimed was concerned, the company failed and the action as against the Minister of Supply must be dismissed. On the second point, with one exception, his Lordship did not think that the controller had exceeded his powers. The exception arose in this way: The controller thought that the company required greater financial resources, and he had directed them to increase their overdraft at their bank. The company were unwilling to borrow more money, and the bank were not prepared to advance any more money to the company themselves. The bank were only willing to make a further advance on a guarantee by the Government. But the question of an advance was a matter wholly for the company, and not for the controller. The controller was, in fact, ordering the company to undertake some new liability which they could not undertake out of their own resources. The plaintiffs were entitled to relief in respect of the direction to increase the overdraft of the company, but no further, and he would make a declaration to that effect, with liberty to apply for an injunction. He would award the plaintiffs half the costs of the action.

ROWLAND

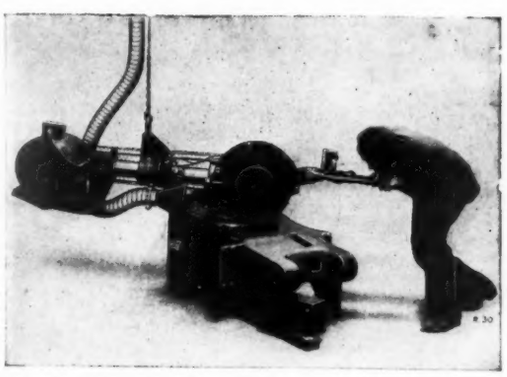
"High Speed"

30" MOTOR-DRIVEN HIGH SPEED GRINDER

YOU can definitely save money in your Fettling Shop by installing "Rowland" High Speed Grinders. There are four sizes of Floor Machines for work that can be conveniently handled, and Portable Machines for work which is too heavy to carry to an ordinary Grinder.

GRINDING MACHINES

HEAVY DUTY HIGH SPEED PORTABLE GRINDER



All these Machines are built to take full advantage of the high metal removing capabilities of the Bakelite Bonded High Speed Grinding Wheel, which is run at a service speed of 9,500 feet per minute, nearly twice the speed of the ordinary Grinding Wheel. Built to withstand continuous heavy duty these sturdy Grinders are the last word in up-to-the-minute Fettling Shop practice.

● **WRITE FOR DETAILS, for you cannot afford to run antiquated Slow Speed Grinders.**

F. E. ROWLAND & CO., LTD.,
CLIMAX WORKS REDDISH, STOCKPORT

The Week's News in Brief

Trade Talk

THE [AMERICAN] FOUNDRY EQUIPMENT Manufacturers' Association reports record sales for the month of April, at 538.2 per cent. above the datum line—the average for 1922-23-24.

THE L.M.S. RAILWAY has reported to the Iron and Steel Control that it has salved 110,000 tons of scrap iron and steel and reconditioned a further 10,000 tons which in normal times would have been replaced by new material.

CIRCULARS HAVE BEEN POSTED from Holland to the United States, and possibly elsewhere, signed "International Tin Research and Development Council—Statistical Office." The Council points out that, following the invasion of Holland by Germany, the statistical office at The Hague was closed. Since that time there has been no contact or communication of any kind between the Council and the organisation at The Hague, which, it must be assumed, is under Germany's control, and is not in a position to issue reliable information. It will also be understood that the organisation at The Hague issuing such circulars is now entirely divorced from the tin-producing interests in the allied countries, including the Netherlands East Indies. The Statistical Bulletin is now issued from Fraser Road, Greenford, Middlesex. The latest bulletin estimates world production of tin in May at 22,200 tons, making a total for the first five months of 96,000 tons, compared with 85,400 tons in January-May, 1940.

Personal

DR. WILLIAM CULLEN has been elected president of the Society of Chemical Industry, succeeding Prof. J. C. Philip, acting Rector of the Imperial College.

DR. W. D. JONES, consulting metallurgist, has changed his address from 101, Leadenhall Street, London, E.C.3, to Commonwealth House, 1-19, New Oxford Street, W.C.1.

LORD BEAVERBROOK, Minister of State since May 1, and previously Minister of Aircraft Production, has been appointed Minister of Supply in place of Sir Andrew Duncan.

COL. WILLIAM H. WIGGIN has been appointed vice-chairman of W. & T. Avery, Limited, Soho Foundry, Birmingham. Mr. Austin Morley, the general manager, has been appointed a director.

MR. CYRIL E. LLOYD, a director of N. Hingley & Son, Limited, Netherton, and M.P. for Dudley from 1922 to 1929, has been invited by the Dudley Conservative Association to be a candidate at the forthcoming by-election.

MR. EDMUND J. LOWE and MR. WALTER SHAW have been appointed local directors of Thos. Firth & John Brown, Limited, Sheffield. Mr. Lowe has been assistant works manager for a number of years, and Mr. Shaw has been associated with the shell production side of the company's business.

MR. AND MRS. ROBERT COWAN WADDELL, of Hillington Road, Cardonald, Glasgow, celebrated the fiftieth anniversary of their wedding on July 1. Mr. Waddell, who has been a member of the Institute of British Foundrymen since 1911, is a director of Wm. Cumming & Company, Limited, of Glasgow and elsewhere.

MR. C. E. WESTOVER has been elected executive vice-president (managing director) of the American Foundrymen's Association in place of Mr. C. E. Hoyt, who has resigned in order to devote himself entirely to the organisation of the Association's exhibitions and conventions. Mr. Westover is a graduate of the University of Nebraska. After a lengthy experience in iron, and non-ferrous foundry practice, he was, before assuming his new position, works manager of the Burnside Steel Foundry Company of Chicago. He has long been active in the work of the A.F.A. and in 1939 presided over the Chicago Chapter.

Wills

SLINGSBY, CHARLES, of Bradford, a director of Walter Slingsby & Company, Limited, tube fittings manufacturers, Keighley £41,593

BAILEY, COL. A. J., governing director of Sir W. H. Bailey & Company, Limited, engineers, iron and brass founders, of Salford £31,629

Obituary

MR. JOHN WILLIAM BEST, chairman of the Darlington Wire Mills, Limited, has died at his home in Sheffield. He was in his 80th year.

MR. ANDREW PARKINSON, London representative of Swan, Hunter, & Wigham Richardson, Limited, shipbuilders, of Newcastle-upon-Tyne, died on June 26, aged 67.

MR. DANIEL MACCALLUM GIBB, late managing director of the Parkinson Stove Company, Limited, Birmingham, died on June 28 at Farnham, Surrey, at the age of 74.

MR. STEWART BARRY, one of the managing directors of William Jacks & Company, Limited, died recently after a long period of indifferent health. Mr. Barry joined the firm of William Jacks & Company, Glasgow, in 1889, and went to London in 1894.

MR. C. PETER SANDBERG, head of the firm of Sandberg, the consulting and inspecting engineers, of Grosvenor Gardens, London, died on Thursday, June 26, at the age of 65. Mr. Sandberg was trained as a civil engineer and was best known to our readers as the inventor of the well-known process bearing his name for the treatment of steel rails. During the war of 1914-18 this process was applied to the treatment of shell forgings, for which work the inventor was awarded the C.B.E. in 1920. He also acted as consulting engineer to numerous railway companies, notably in China and Siam, for which work he was made a Commander of the Chinese Order of Chia Ho in 1922 and a Commander of the Siamese Order of the White Elephant in 1925. The most spectacular achievement of his career was in 1932-33, when, in association with a foreign salvage company, he recovered nearly all the treasure from the sunken "Egypt" off Ushant. This P. & O. liner foundered in May, 1922, with about £1,000,000 in gold and silver on board, and although she lay in about 400 ft. of water, Mr. Sandberg, in collaboration with others, undertook and successfully achieved salvage of her valuable cargo. Search for the wreck was commenced in August, 1928, and it was located definitely in August, 1930. Two years later the first gold was recovered and the search continued until 91 per cent. of the sovereigns, 98 per cent. of the bullion, and 97 per cent. of the silver ingots were wrested from the ill-fated ship. Mr. Sandberg was also a director of British & Dominions Ferroalloys, Limited, Gearless Transmission, Limited, Humfrey-Sandberg Company, Limited, and Sheffield Testing Works, Limited. He was a member of the Iron and Steel Institute, joining in 1898.

DR. JOSEPH WARD, J.P., chairman and managing director of Thos. W. Ward, Limited, died at his residence, Endcliffe Grange, Sheffield, on July 7, after being seriously ill for several weeks. He was 76 years of age. In 1878 he joined his elder brother, the late T. W. Ward, the founder of the firm which bears his name, entered into partnership with his brother in 1889, became joint managing director at the incorporation of Thos. W. Ward, Limited, in 1904, and has been chairman since 1919. The deceased took a leading part in the formation of the Ketton Portland Cement Company, Limited, of which he was chairman and managing director. He was also chairman of Ribblesdale Cement, Limited, Thos. Smith & Sons (Rodley), Limited, the Midland Iron, Limited, Marshall Sons & (Successors), Limited, and of the subsidiary and associated companies of the Ward organisation. Recognised as one of the leading authorities on shipbreaking and the scrap-iron and steel industry, he served in a scrap iron and steel advisory capacity to the Ministry of Munitions in the Great War. Mr. Ward was made J.P. in 1922, and elected Master Cutler in 1931. As chairman of the Applied Science Department and latterly as treasurer, he rendered valuable service to Sheffield University and the honorary degree of LL.D. was conferred on him in 1939. Last year he was elected a Town Trustee. His consideration for the welfare of his employees has been shown in various ways; during the Jubilee celebrations of Thos. W. Ward, Limited, a block of shares was given to each employee with over 15 years' service. At the opening of new staff dining rooms and library in February last he presented long-service certificates to all staff and workmen who had given over 25 years' service to the company.

Reports and Dividends

Triplex Foundry, Limited—Dividend of 5 per cent. (same).

Peter Brotherhood—Final dividend of 12%, making 20% (same).

Electric Furnace Company—Final dividend of 4½%, making 8% (7%).

Swan Hunter & Wigham Richardson—Interim dividend of 4% (same) on the ordinary stock.

South Crofty—Profit for 1940, £21,392; brought in, £276; depreciation, £2,327; dividends, £17,550; forward, £1,792.

Allied Ironfounders, Limited—Dividend on the ordinary shares of 6 per cent. for the year ended March 31 (5 per cent.).

Cannon Iron Foundries, Limited—Consideration of the dividend payment on the 5½ per cent. redeemable cumulative preference shares is postponed.

Baker Perkins, Limited—Profit for 1940, before deduction of income-tax and E.P.T., £200,569 (£151,025); final dividend of 3½ per cent., making 7 per cent. (same).

Whessoe Foundry & Engineering—Net profit to March 31, £147,810 (£134,630); tax, £97,049 (£65,000); dividend of 40% (same); forward, £41,503 (£30,742 brought in).

Armstrong Whitworth Securities Company, Limited—Net income for 1940, £1,937 (against £1,828 for 1939), increasing the balance carried forward to £21,464.

Harland & Wolff, Limited—Dividend of 6 per cent. (same) on the "A" ordinary shares, less tax at 11s., and a dividend of 6 per cent. (4 per cent.) on the "B" ordinary shares, less tax at 10s.

Jury Holloware (Stevens), Limited—Profit for the year to March 31 last, £94,523 (£33,206); taxation, £73,358 (£17,439); dividend of 10 per cent. (7 per cent.); carried forward, £13,991 (against £15,826).

Whitehead Iron & Steel Company, Limited—Net profit, after tax and depreciation, for the year to March 31, £216,163 (against £264,902 for 1939-40); dividend of 20 per cent. (same); to general reserve, £60,000; carried forward, £33,009 (£33,613).

Harland Engineering Company, Limited—Profit for 1940, after providing for depreciation and taxation, £11,754 (£19,385 in 1939); brought in, £14,575; reserves, £2,000; War Damage contributions, £2,000; A.R.P., £2,500; dividend on the 6 per cent. preference shares, £3,225; ordinary dividend of 3 per cent., £2,100; carried forward, £14,654.

Parkinson & Cowan, Limited—Net profit for 1940, after making provision for debenture service (£11,508), taxation, depreciation, War Damage Insurance, etc., £55,843 (£25,708); brought in, £33,379; preference dividend to September 30, 1940, £20,748; ordinary dividend of 3 per cent., £11,160; to reserve, £25,000; carried forward, £32,314.

Bradley & Foster, Limited—Trading profit for the year to March 31, £28,279; provision for taxation, including E.P.T., £14,742; to depreciation reserve, £2,127; brought in, £8,994; to general reserve, £5,000; interim dividend on the ordinary shares of 4 per cent. actual, £1,767; final dividend on the ordinary shares of 6 per cent., plus a bonus of 2½ per cent., £3,266; carried forward, £10,370.

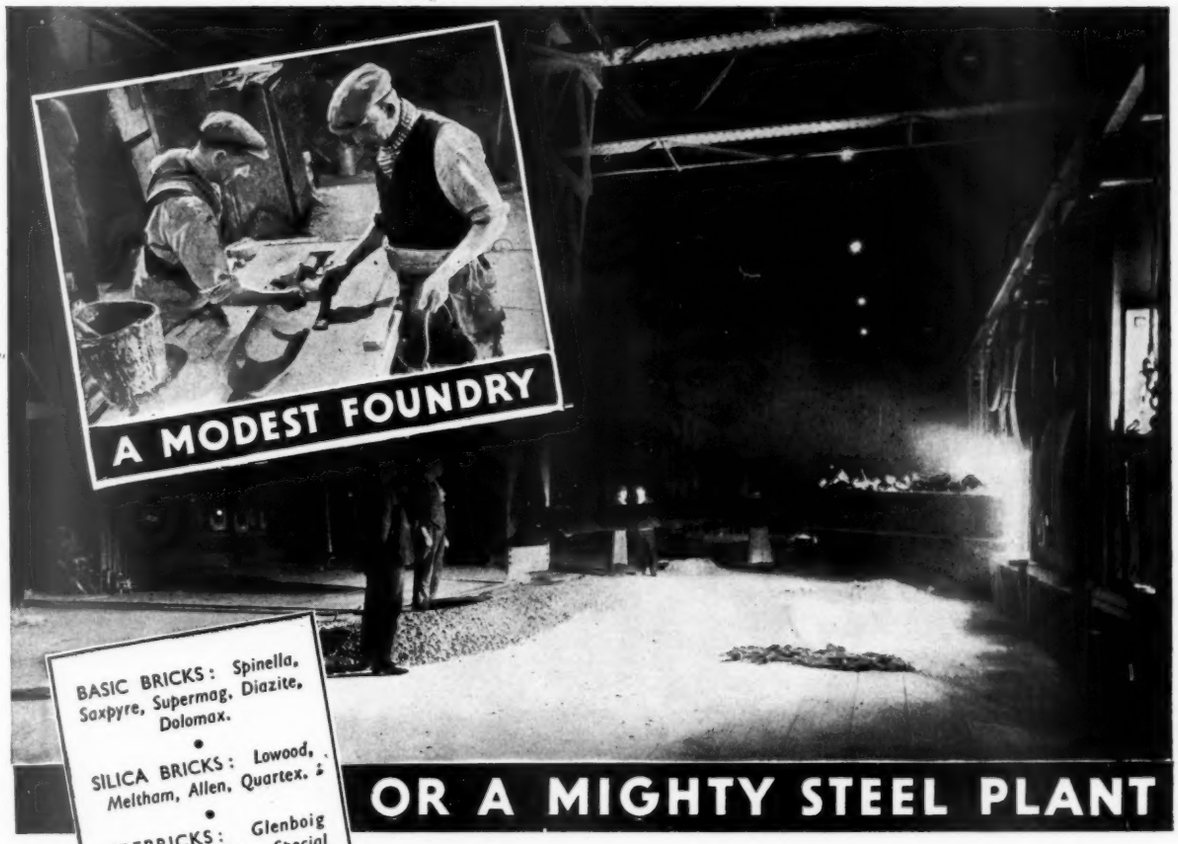
Foundry Technique in the Production of High Strength and other Types of Alloy Grey Iron Castings

(*Concluded from page* 21)

liquid shrinkage porosity immediately beneath risers. On no account should rod or puddle feeding be employed unless solely for the purpose of preventing the top of a self-feeder from freezing too early or used with "off the casting" feeders.

(7) Slow running methods may sometimes be used with advantage, taking care that the rate of pouring is really slow and the metal used is at a sufficiently high temperature.

Since all high-duty cast iron must be poured at a high temperature other difficulties may arise, such as distortion of cores, where large masses of metal surround comparatively small and fragile cores, but with sufficient ingenuity these factors can easily be overcome.



BASIC BRICKS: Spinella, Saxpyre, Supermag, Diazite, Dolomax.

•

SILICA BRICKS: Lowood, Meltham, Allen, Quartex.

•

FIREBRICKS: Glenboig Special, Glenboig Special Crown, Glenboig, Glenboig Crown, Castlecary, Dykehead, Gem, White Carr, Stour, Hycone.

Alumantine, Hysilyn, Adamantine, Llangennech.

•

CEMENTS: Sintex, Durax, Pyrolyte.

•

INSULATION: Amberlite Bricks, Cement & Concrete.

•

SANDS: Moulding, Brick Facing, Silica, Glass.

•

PLASTICS: Durax, Rotaline, Plastic K-N, Glendoline Ground Ganister.

•

SILLIMANITE: Tank Blocks, Bricks and Cements.

•

ACID-PROOF REFRACTORIES: Obsidianite, Losol.

•

. . . both bring their Refractory problems to General Refractories

BETWEEN users who exercise meticulous care and foresight in the selection of refractories and those who buy 'cheaply' regardless of quality—there are large numbers who acknowledge the value of a suitable refractory for their business, but lack the specialised knowledge, equipment and staff to compare refractory values. To them the General Refractories organisation has much to offer. For example, the "G.R." range of products will provide maximum service and efficiency for any stated purpose—"G.R." laboratories and staff are qualified to understand the problems of a user, to recommend the correct product and supply sound reasons for its selection. Thus users are assured of impartial and helpful service in selecting refractories. The continually increasing number of firms who make use of the "G.R." Technical Advisory Service is significant of the growing importance placed by users on the sound selection of refractories. With the changes imposed by war-time supplies of raw materials and production conditions, the vast resources of General Refractories are a definite assurance to users of maximum value-for-money.

G.P.4

GENERAL REFRACTORIES LTD.

HEAD OFFICE: GENEFAX HOUSE, SHEFFIELD, 10. TELEPHONE 31113 (6 LINES)

Raw Material Markets

Consumers of pig-iron have not been slow to purchase their licensed tonnages for the third quarter of the year. Most grades of iron continue to be fully absorbed, but no difficulty or delay is experienced in obtaining high-phosphorus and refined qualities produced from home ores. The chief tightness, of course, is in low-phosphorus and hematite irons, the manufacture of which incurs the use of imported ores. Heavy engineering works and the steel plants are the largest consumers of these grades and, being employed mainly on urgent contracts, have preference in the distribution of supplies.

Pig-Iron

MIDDLESBROUGH—Licences have been issued and orders placed for foundry iron supplies for the third quarter of the year. Consumers have had no difficulty in booking their requirements, as Midland makers of this type of iron are easily able to look after all demands and to deliver promptly. Production of foundry iron in the Cleveland area is still in a state of virtual suspense, the output which does become available from time to time making but a minute contribution to needs, but in view of the satisfactory supplies forthcoming from the Midlands little, or no, inconvenience is caused thereby. Consumption continues to be well below the level of peacetime standards, owing to the fact that few works are operating at anything approaching capacity, as the contribution which the light foundry trade is able to make to war projects is strictly limited, and many normal outlets of the industry are now closed entirely or severely restricted.

Local blast furnaces are practically fully engaged on the production of iron for steelworks' purposes. Hematite is in great demand, but the tonnages available are not sufficient fully to satisfy all requirements, and a certain amount of imported iron continues to be allotted by the Control authorities to high-priority users. In addition to the heavy pressure for hematite on the North-East Coast, there are also substantial supplies asked for by consumers in Sheffield and the Midlands, and orders from these districts are being dealt with as and when possible. Refined and high-phosphorus irons are being utilised in works' mixtures in place of hematite, but there is a limit to the extent to which this rearrangement can be carried out.

LANCASHIRE—Iron consumers associated with the war effort in the Lancashire area continue to operate to capacity and to make corresponding heavy demands on Midland manufacturers of iron, all of which are being readily satisfied. But other users, such as makers of light castings and jobbing founders, are still not well placed for new business, and short time is general among these concerns. High-phosphorus iron for light founders and jobbers is in ample supply, but there is some tightness in better quality irons for the machine-tool, heavy electrical and other speciality engineers, although the Control are carefully distributing iron according to the nature of the work on hand at these establishments, and all urgent demands are promptly met.

MIDLANDS—With full-scale operations continuing at heavy engineering works, consumption of pig-iron is maintained at a level which is taxing the limits of the producing plant. This is more especially the case in connection with low-phosphorus and hematite irons, and it is not possible to deliver all the iron required, although the situation is relieved by virtue of the use of other grades of iron produced from home ores, such as high-phosphorus and refined qualities. In this way production at the consuming plants is not impaired. Most of the heavy-castings makers are booked up for months ahead with contracts of an urgent nature for Government departments and other important bodies, and there is every prospect of additional orders being placed. The supply of high-phosphorus iron and of refined material is quite satisfactory; while a moderate tonnage is being taken up by works producing heavy castings, the chief user of high-phosphorus iron, the light-castings industry, is poorly situated for business, and consumption in this respect is still rather low. It has been possible in some instances for light founders to adapt their plant to cope with the production of heavier products, and thus they have been able to acquire a certain amount of Government work, but, as yet, only a few foundries in this trade are happily placed.

SCOTLAND—Operations among light-castings makers remain much under capacity, except in those foundries which are able to cope with Government orders, as the cessation of housebuilding has sharply curtailed the demand for the products of these works. Foundrymen are able to get all the iron they require from furnaces in the Midlands of England, and, in fact, have laid down small stocks in some instances. Production among the heavy engineers is maintained at a high level, and there is a ready market for all their output.

Coke

The demand for foundry coke for immediate use is keen, and it is satisfactory that the ovens are in a position to meet all requirements promptly. In fact, many consumers are successfully carrying out a programme of systematic stocking. For delivery to Birmingham and Black Country stations, the current quotation of Durham best foundry coke is 62s. 9d. per ton.

Steel

Notwithstanding the large demand for steel, the position of British makers is eminently satisfactory, and has, in fact, shown appreciable improvement of late. Prior to the commencement of the second half of the year many steelworks were able to make up considerable leeway in the schedule of deliveries, and the carry-over was not nearly so high as at one time appeared probable. Thus, with a more or less clean slate, steelmakers have set about tackling their third-quarter commitments, all of which, of course, are sanctioned by the Iron and Steel Control. The better condition of the industry will not make for any easing of the regulations governing the restricted use of steel. The export trade is still virtually suspended, and any shipments made are in connection with steel for use abroad for the furtherance of the British war effort.

Scrap

Scrap iron and steel merchants continue promptly to dispose of all the material they can lay their hands on, and much larger tonnages could be sold if available. Cast-iron scrap for the iron-foundries is in keen demand, and deliveries generally are steady. Scrap metal is being used freely in foundry mixtures in view of the shortage of the qualities of iron normally absorbed by the furnaces. Steelworks are still not getting all the scrap they would like; in some cases a deficiency in the supply of good, heavy steel scrap is made up by the use of mixed heavy iron and steel scrap.

Metals

COPPER—With manufacturing concerns fully extended on orders associated with the war effort, very large tonnages of copper are passing into consumption, and it may be presumed that still more substantial quantities will be absorbed as munitions production facilities are expanded. The copper supply position in the United States is anything but free, but it is, nevertheless, hoped to assist the Soviet Union with copper. U.S.A. exports of copper to Russia in 1940 totalled 58,500 short tons, but since then further restrictions have been placed on copper trading in America owing to the heavy requirements of the defence programme. Complete priorities, it is understood, have been established in America, and will become effective on August 1. Meanwhile, it is indicated that the Office of Production Management will shortly fix the July emergency pool at 20 per cent. of the April domestic production of refined copper, the same as in June. Little surprise would be caused if a maximum price for copper in the United States were to be brought into operation.

It is understood that a second consignment of 1,000 tons of copper is to be despatched to Portugal shortly by the British Government. The metal, which will be conveyed by British vessels, is urgently required for the manufacture of copper sulphate for the spraying of vines.

TIN—Rumours were current in tin circles at the end of last week that Russia was in the market for supplies for shipment from the Straits to Vladivostok, and quotations in London closed higher in consequence. Reports of Soviet purchasing have stimulated the market considerably, buying having been much brisker than of late. On Monday last, however, hedging operations by smelters caused buyers to withdraw much of their support, and prices fell by 50s. and 30s. respectively for cash and three months' tin as compared with the close on Friday.

The position of the American Metals Reserve Company in respect of tin remains somewhat enigmatic, purchases to date being far behind the schedule of the first pronouncement of the company, which was to buy 75,000 tons of tin by the end of June last. Later it was announced that 150,000 tons was to be accumulated. Prices in the United States continue to be much in excess of the official buying price of the Metals Reserve Company.

The total visible supply of tin at 33,545 tons was 3,646 tons lower at the end of June as compared with the figure recorded on May 31, according to statistics compiled by Mr. W. H. Gartsen (Henry Rogers, Sons & Company). The carry-over in the Straits Settlements in June was 3,095 tons, against 2,400 tons in May, while the carry-over at principal European smelters was 2,351 (1,594) tons. Deliveries, which totalled 17,044 tons in June, compared with 13,944 tons in May, were made up as follow:—United Kingdom, 757 (836) tons; United States, 14,880 (10,490) tons; Continent (except Holland), nil (500 tons); other countries, 1,407 (2,118) tons.

Tin prices on the London Metal Exchange during the past week have been as follow:—

Cash—Thursday, £258 10s. to £259; Friday, £261 to £261 5s.; Monday, £258 10s. to £259; Tuesday, £257 5s. to £257 15s.; Wednesday, £256 15s. to £257.

Three Months—Thursday, £262 5s. to £262 10s.; Friday, £263 15s. to £264; Monday, £262 to £262 5s.; Tuesday, £260 15s. to £261; Wednesday, £260 10s. to £260 15s.

SPELTER—Both in this country and in the United States the bulk of consumption of zinc is on account of defence contracts, and careful distribution is keeping priority users well supplied. It is likely that Russia will need imported zinc to assist in her war effort; in peacetime consumption and production are believed to have been both at around 90,000 metric tons per annum, but it is inevitable that the war machine will call for much larger tonnages.

LEAD—Cable makers and other manufacturers engaged on important work are using lead quite freely, but the supply situation remains comfortable, consumption in housebuilding and other peacetime industries having declined appreciably. The American market is strong, and a system of priorities is expected to be introduced shortly. Domestic deliveries in the United States during May last were heavy, totalling 88,000 short tons, of which 60,382 tons was domestic metal. It is reported that the Government of the U.S.A. is negotiating with Canadian, Mexican and Peruvian lead producers for the delivery of increased supplies.

SCRAP—Non-ferrous metal scrap, with the exception of the brasses, appears to be moving quite freely. Brass is very difficult to dispose of, and many dealers turn a deaf ear to fresh offers for the time being.

Formation of Iron Carbonyl

By the action of CO on steel, iron carbonyl is formed, and various investigators have studied the equilibrium concentrations of CO in relation to pressures up to 1,000 kg. per sq. cm. and temperatures up to 380 deg. PICHLER and WALENDA, in "Brennstoff Chemie," have continued this work, and for a cast iron and a series of steels they have determined the loss of weight due to the formation of CO and the degree of carburisation resulting in a temperature range from 100 to 250 deg. and a pressure range of from 150 to 1,000 kg. per sq. cm.